BULLETIN
DE L'INSTITUT D'ÉGYPTE

TOME XXXVII
(FASCICULE 2)
SESSION 1954-1955

IMPRIMERIE DES EDITIONS UNIVERSITAIRES D'EGYPTE
41, RUE CHÉRIF PACHA — LE CAIRE
1956

INSTITUT D'EGYPTE

COMMUNICATIONS ET PROCÈS-VERBAUX



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"فتوح القبلة"

"CONQUETES DU MIDI"

SUR UNE

EMISSION DE MONNAIES TURCO-EGYPTIENNES (1)

par Marcel Jungfleisch

Un coup d'œil d'ensemble jeté sur la numismatique égyptienne au cours des âges conduit à formuler cette conclusion paradoxale : les périodes les plus rapprochées de nous dans le temps sont celles que nous sommes le plus éloignés de bien connaître.

N'étaient les planches de J. J. Marcel(2) et le mémoire de Samuel Bernard(3) dans la Description de l'Egypte, n'était la remarquable thèse de Fouad Sultan (4), nous ignorerions à peu près tout de la numismatique de l'Egypte durant les siècles qui précèdent immédiatement le nôtre.

Les nombreuses frappes de Ptolémée Soter ou d'Hadrien, anciennes respectivement de 23 et 19 siècles, nous sont connues, familières même, mais celles de Selim I ou de Soliman I, datant de 5 siècles à peine, nous échappent tout comme celles du siècle dernier — d'hier. Cette anomalie est mise en évidence par l'ouvrage de Valentine(5) qui présente le rare mérite d'avoir, quant aux bronzes islamiques, doublé les connaissances léguées par les auteurs antérieurs. Malgré ce louable résultat, Valentine n'a relevé dans les Musées, les catalogues et les collections particulières, entre les années 922 et 1223 de l'Hégire (1516 - 1808 D.) soit pour une période de trois siècles, que 19 types frappés sur le cuivre en Egypte, dont la moitié presque appartient au règne de Selim I. Par contre, pour des durées ne

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(1) Communication présentée en séance du 15 novembre 1954.

(2) J.J. Marcel — Planches h, i, k, — 2e édition de la Description. L'Egypte, Etat moderne.

(3) Samuel Bernard — Mémoire sur les monnaies d'Egypte — 2e édition de la Description, tome XVI. p. 267.

(4) Fouad Sultan — La monnaie égyptienne — Paris, 1911.

(5) W.H. Valentine — Modern Copper coins of the Muhammadan States — London, 1911.

dépassant pas le demi-siècle, Dattari[1] a pu cataloguer plus de 500 variétés de bronzes "alexandrins" frappés par Hadrien et environ 550 par Antonin. La comparaison entre ces deux ordres de grandeur est d'autant plus significative que cette pauvreté apparente des séries musulmanes ne provient pas entièrement d'un manque de matériel; il semble qu'il faille plutôt en incriminer la négligence des numismates orientalistes. Récemment encore, les monnaies ottomanes d'Egypte se rencontraient en abondance dans les sébiles des changeurs et aux éventaires des brocanteurs. Il a fallu les guerres qui ont enchéri le cuivre — et le défaut persistant d'amateurs — pour que peu à peu elles partent à la fonte. Peu coûteuses, ces pièces étaient pourtant intéressantes à plusieurs points de vue, elles procuraient d'heureuses surprises à qui voulait bien leur consacrer un peu de temps. Ce qui suit en est un exemple frappant.

Les défaites des Persans en Asie-Mineure, l'invasion rapide de la Syrie par Selim I, son éclatante victoire sur le Sultan Mamelouk el Ghoury tué à Mar Djabick près d'Alep le 25 Ragheb 922 H. (22 août 1516 D.) sont présentes à toutes les mémoires. La suite est également connue : une campagne d'hiver vivement menée bouscula devant Ghaza les Mamelouks désunis; ceux qui se rallièrent à Touman-bey furent dispersés le 28 Zil-Hegga 922 H. (22 janvier 1517 D.) sans avoir réussi à protéger le Caire où le conquérant turc entra le même soir. Une révolte de trois jours dans la capitale, puis une vaine tentative de guerilla en Haute-Egypte ne suffirent pas à en imposer à Selim I; installé dans un palais à la pointe méridionale de l'île de Rodah, il put dès lors s'adonner sans obstacles sérieux à son penchant pour les belles-lettres. En six mois, il avait conquis tous les pays depuis le Taurus jusqu'à l'Ethiopie: les conquêtes du Midi; un nouvel état de choses se trouvait établi, au spirituel comme au temporel. Les contemporains de semblables événements ne pouvaient se méprendre sur leur importance.

La numismatique conserve habituellement trace des principaux faits historiques; de prime abord, elle semblait muette quant à celui-ci, les recherches dans les livres n'ayant permis de retracer aucune monnaie ou médaille s'y rapportant.

Restait à examiner de visu, toutes les monnaies de cette époque n'ayant pas encore reçu d'attribution. Parmi la masse des "inclassées", notre attention fut attirée par une variété de pièces en bronze plus ou moins fortement mélangé de cuivre rouge, variété qui se distinguait à première vue des autres par son épaisseur disproportionnée eu égard à son diamètre (épaisseur atteignant jusqu'au tiers du diamètre)[1].

Les mesures moyennes sont de cinq à six millimètres environ pour l'épaisseur et de seize à dix-neuf millimètres au maximum comme diamètre. Il est impossible de donner des chiffres plus précis car il n'existe pas deux pièces ayant les mêmes dimensions relatives; de plus sur une pièce donnée, épaisseur et diamètre varient sensiblement suivant l'endroit où l'on les mesure. En général, la tranche présente une section nette et sans craquelures, elle est parfois légèrement convexe; elle n'est jamais rigoureusement perpendiculaire aux faces qui par ailleurs ne sont pas exactement parallèles entre elles.

Suivant une coutume déjà séculaire à cette époque, le diamètre des coins destinés à frapper dépassait notablement le module des pièces à confectionner. Par suite, les légendes ainsi imprimées sur le droit et le revers sont toujours fort incomplètes, elles ne présentent entre elles aucune constance d'orientation, ni aucun centrage commun. Le manque de netteté des caractères fait présumer une frappe exécutée en une seule passe avec des coins médiocres sur un alliage qui manquait de ductilité. Les poids variant entre 10 gr. 38 et 12 gr. 06 ne nous apportent aucune indication métrologique précise.

La réunion de ces observations permet de conjecturer avec une vraisemblance suffisante la technique des monétaires égyptiens d'alors. Le métal provenait de la refonte de monnaies antérieures (principalement de cuivres mamelouks) et d'objets hétéroclites de compositions variables. Quand sa qualité avait été trop altérée par l'oxydation, on lui ajoutait du métal neuf: cuivre ordinaire ou mieux cuivre rouge. L'alliage, imparfaitement brassé et mal débarassé des crasses, était coulé en mattes grossières qui étaient aplaties irrégulièrement par martelage sur une enclume. On imprimait les coins à même la plaque avant d'en avoir découpé les flans; les empreintes faites sans repérage précis ne se superposaient pas exactement d'une face à l'autre. Les dimensions des coins excédant notablement le diamètre des pièces

(1) G. Dattari — Nummi Aug. Alexandrini — Cairo 1891.

(1) Nos recherches ayant eu pour point de départ, cet aspect extérieur, nous suivrons le même ordre — contraire à l'usage — pour n'arriver au déchiffrement qu'in fine. Ce mode exceptionnel de description présente l'avantage de reproduire la marche de nos investigations.

à produire, les parties imprimées qui se chevauchaient d'une face à l'autre suffisaient lors du découpage pour circonscrire sans vides d'inscriptions des monnaies sensiblement plus petites (environ d'un tiers) que les coins. Le dégagement des flancs se pratiquait probablement au moyen de la scie à métaux formée d'une lame étroite et était suivi d'un rapide ébarbage des tranches à la lime. Il ne se faisait pas de mise au poids individuelle pour chaque pièce; les artisans avaient acquis à force d'habitude, un tour de main suffisant pour livrer des sacs contenant un nombre convenu de pièces, le poids global de chaque sac ne s'écartant pas trop du chiffre fixé. Cette métallurgie rudimentaire était en grande partie un héritage de la période mamelouke.

Il est dès lors facile de comprendre pour quelle raison les légendes imprimées sur ces monnaies sont toujours incomplètes ce qui en rend le déchiffrement plus ardu et moins certain. En pareil cas, le seul moyen de tourner la difficulté consiste à réunir le plus grand nombre possible d'exemplaires ou de moulages de monnaies du même type existant dans les grandes collections. Ils se complètent les uns par les autres et il devient alors possible, tout en gardant une certaine prudence, de tenter la reconstitution générale du type.

Vers 1927, nous avions déjà réuni sept exemplaires de conservations fort inégales (trois passables, deux médiocres et deux mauvais) lorsque l'un de nos fournisseurs nous apprit qu'Ahmed Zaki Pacha(1), s'était longtemps intéressé au même problème. Il avait défini la méthode, il était parvenu à déchiffrer presque complètement le droit et une partie du revers, mais comme il ne possédait pas assez d'exemplaires, il n'avait pu progresser plus avant. Sur son conseil, nous nous étions alors adressé au Cabinet des Médailles de la Bibliothèque Nationale, à Paris. Avec l'aide de M. G. Bataille, à l'époque bibliothécaire-adjoint, il fut possible de repérer trois pièces du même type parmi les "inclassées" du Cabinet et feu A. Dieudonné, Conservateur, avait eu l'extrême obligeance d'en faire exécuter des moulages excellents qui furent rapportés en Egypte.

Vu la faiblesse des reliefs et la médiocrité de la conservation du mauvais métal, la photographie n'est guère utilisable en cette occurence ; nous aurons recours au dessin.

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(1) Il fut un Maître et un Animateur à la mémoire duquel nous saisissons l'occasion de rendre un pieux hommage. Sans l'aide de sa perspicacité et de sa persévérance, jamais la présente étude n'aurait été menée à bien.

I—CABINET DES MEDAILLES. PARIS.

Voici donc les dessins des trois exemplaires de Paris au double de leur grandeur naturelle, dessins aussi fidèles que faire se peut.

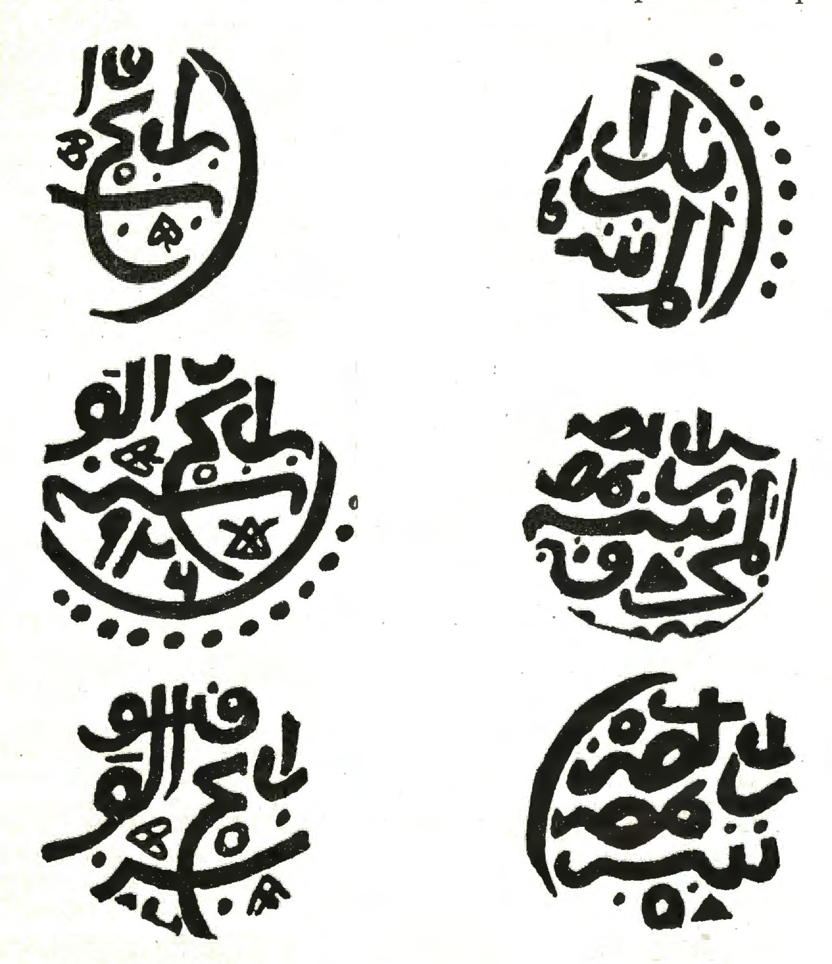


FIG. 1

Ces trois pièces sont d'une conservation aussi bonne que possible vu la mauvaise qualité du métal. Elles n'ont pas été frappées avec les mêmes coins, ceux des droits diffèrent et ne semblent pas gravés par la même main. Il est fort possible que les ornements [ornement], [ornement], [ornement], figurant au droit sous سنة constituent de véritables "différents" au sens monétaire du mot.

Le premier coin porte la palmette entre deux points.

Sur le second la palmette est remplacée par un entrelac de style mamelouk, non cantonné de points.

La palmette du troisième ne porte pas de queue visible et n'est pas cantonnée de points.

En 1929, ces recherches avaient abouti à une impasse. Certaines parties des légendes semblaient se contredire les unes les autres et les dates venaient encore aggraver l'incertitude. La cinquième année du règne de Selim I (918 - 926 H) était 922 H. effectivement celle de la prise du Caire qui parachevait les "Conquêtes du Midi" mais alors que signifiait la date de 926 H. qui n'était pas la cinquième du règne ni celle de la conquête de l'Egypte ? Par ailleurs, il semblait matériellement difficile que des émissions aussi nombreuses aient pu être faites au cours des quelques jours qui, après la prise du Caire, restaient à courir dans cette année 922 H. De plus, elles auraient été peu politiques dans un pays tout nouvellement occupé, à grande distance des bases de départ et où le pouvoir ottoman n'avait pas encore eu le temps de s'affermir; les autres mesures prises par Selim I vis-à-vis de ce qui restait des Mamelouks témoignent en outre d'un esprit tout autre.

II — EXEMPLAIRE DE 1948

En 1948, nous eûmes la chance de rencontrer un huitième exemplaire en assez bon état. Il se rapproche du type 3 de Paris mais il présente un point à gauche du ٥ qui surmonte سنة. Incomplet comme tous les autres, il est cependant plus large et se trouve par hasard mieux centré si bien qu'il nous a été d'un précieux secours. En voici le dessin :





FIG. 2.

III — RECONSTITUTION DU TYPE[1]

La reconstitution générale du type schématique devenait dès ors possible. En faisant abstraction des variantes mineures, elle se présente comme suit :



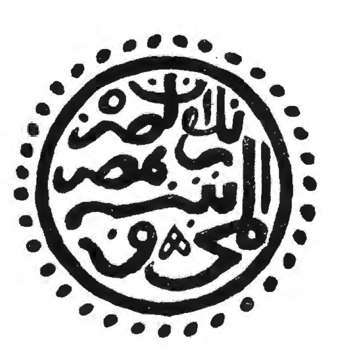


FIG. 3.

ou plus cursivement

D/		R/
فتوح		بلاغ تنصره
القبلة		بمصر
٥ سنة ٩٢٦		المحروسة

ce qui peut se traduire :

D/		R/
Conquêtes		Avis de sa victoire
du Midi		en Egypte
5 année 926		la bien gardée

Remarquons de suite que ces liaisons et ces césures inhabituelles pourraient ne viser qu'un effet décoratif. Toutefois, elles sont bien voulues, de propos déterminé; car elles seules sont rigoureusement invariables sur ces douze exemplaires qui tous diffèrent entre eux par les autres accessoires. Elles auraient donc été à la base du type imposé aux graveurs dont la liberté d'exécution était restreinte aux plus minces détails.

(1) Un neuvième exemplaire trouvé en 1952 est mal conservé.

Nous sommes ainsi mis en présence de toute une série de frappes émises en Egypte avec la date 926 H. Elles présentent un type général uniforme, elles furent assez nombreuses pour avoir nécessité plu-plusieurs jeux de coins entre lesquels on remarque de légères différences dans les accessoires.

L'année 926 H. est partagée entre la fin du règne de Selim I et le commencement de celui de son fils Soliman I (926 - 974 H.). Ces légendes ne mentionnent aucun nom, mais leur teneur quelque peu insolite se rapporte plutôt à Selim I sur sa fin. Apparemment, ces monnaies auraient eu pour but la commémoration du cinquième anniversaire des " Conquêtes du Midi ", Quinquenalia computée suivant la coutume turque (1).

Différant des émissions habituelles tant ottomanes que turco-égyptiennes, cette série répondait à une intention politique évidente: rappeler une campagne aussi glorieuse que profitable afin de susciter un mouvement d'opinion en faveur d'une autre expedition.

Au moment de sa mort survenue à Andrinople le 9 Shawal 926 H. Selim I consacrait les derniers sursauts de son indomptable énergie à bander tous les ressorts de la puissance ottomane. Il voulait d'abord en terminer avec la menace de flanc résultant de la présence à Rhodes des Chevaliers de Saint-Jean (que Soliman I élimina) et dès qu'il en serait libéré, se lancer à la "Conquête du Nord" comme le fit aussi Soliman I.

Il faut donc voir dans ces monnaies plus qu'un remerciement des Mamlouks égyptiens gratifiés par Selim I d'un statut spécial, mieux surtout qu'une adulation banale. Elles appellent par une antithèse voulue le cri de guerre que vont pousser les janissaires de Soliman I dans leur élan irrésistible, mais cette fois vers le Nord, vers Bude.

Il semble difficile de rencontrer un document numismatique à la fois plus intéressant et aussi négligé.

Février 1949.

(1) 1er année = 922, 2e = 923, 3e = 924, 4e = 925, 5e = 926,

Phycosociological Studies of the Marine Algae of Ghardaqa (Red Sea) (1)

by

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I.— INTRODUCTION

In a recent paper (Nasr 1955), the author showed clearly some observations on the climatological and hydrographic factors affecting the marine algae of the Red Sea. The present paper deals with the distribution of algae along our coast in view that a proper picture of the main formation around Ghardaqa can be obtained. As a matter of fact no critical study has ever been attempted.

II.— THE BIONOMICAL DIVISIONS

The Biological Station of Ghardaqa is situated at 27° 7' N, 23° 45 E, just south of the entrance to the Gulf of Suez. Geographically Ghardaqa is in the sub-tropical zone, being 4° N of the Tropic of Cancer, but Indian species of both flora and fauna extend north of Suez, though corals are not well developed there. The Biological Station, however, is in a tropical coral-reef area, with the usual species of corals growing in profusion on the neighbouring reefs.

The area investigated may be divided into the following :

1. The Littoral Belt

This belt extends from the highest water mark to that of the low water level (Cotton 1912). The bottom in most cases is formed of dead corals covered by a thin layer of coarse sand mixed with

(1) Communication présentée en séance du 4 avril 1955.

coral débris. The dimensions of this belt vary in different places; but steeply sloping shores do not occur. Sometimes it extends for a long distance in the lagoons near the Station, where the shore reef extends in places about 250 m. into the sea. In other localities it extends only for few metres, but this is very exceptional. The lower limit of this belt is well defined by the presence of living corals or, on sand, by Diplanthera uninervis, the leaves of which just project above summer low tides. On exposed shores, as at Qoseir, the Diplanthera association extends into the tide-pools of the lower littoral belt. In certain places at the lower limit of the littoral belt a good number of crevices occurs. These vary in size and shape and may reach a depth of two feet, or possibly more, depending on the mode of growth of the corals.

The slope of the littoral belt is remarkably gentle. Except at its lower limit it is not rich in algal vegetation; but certain members of the Phaeophycophyta e.g. Cystoseira Myrica, Cystophyllum trinode, Padina Pavonia and Spathoglossum variabile grow luxuriantly. Such red algae as occur in this belt are to be met with in the crevices and under rocks, needing protection from the strong sunlight. Many more species are found near low water mark, where they are exposed to the air for only short periods in summer and very rarely at all in winter. On the stones on the reef-flats the bases of which remain submerged in pools, various algae are attached e.g. Enteromorpha minima, Ulva Lactuca, Codium adhaerens, Dictyosphæria intermedia, Sphacelaria furcigera and Gelidiella acerosa. The controlling factor in the algal flora of such stones seems to be the circulation of sea-water, since others in stagnant or impure water support but a scanty vegetation.

At Ghardaqa, as generally along some parts of the Red Sea, the shore reef is sheltered by off-lying reefs. At Qoseir, however, and of the coast for many miles thereabout, the shore reef is exceptionally fully exposed to the sea, but it is rarely beaten by the great surges so familiar to explorers of oceanic reefs, largely because the prevailing wind of the Red Sea blows parallel to the shore, NW. while the E and ESE winds are only of moderate strength.

2. *The Sublittoral Belt*

The edge of the shore reef is abrupt everywhere descending precipitously into 1-3 fms., after which is a steep slope of sand with

abundant phanerogams such as Cymodocea ciliata and Halophila stipulacea which form conspicuous beds in the inner lagoon. These die out at a fathom or so. Diplanthera uninervis and Halophila ovalis cover the bottom to about 3 fms. deep, rarely extending below this depth.

The sublittoral belt begins from the boundary line indicating the low water mark at neap tides. At Ghardaqa its upper limit is marked by the beginning of the Diplanthera-association on the muddy sand shores, or by the Sargassum-associatoin on the dead shore reef; quite homologous to the Alaria and Laminaria vegetation of the temperate zones. The sublittoral belt at Ghardaqa comprises the slopes of coral reefs and the lagoons between them. The surface of the reefs is nearly flat and without raised edges or moats and belongs mainly to the sublittoral belt; only small parts being classed as littoral. In contrast to this view Svedilius (1906), as a matter of fact, considered similar reefs in Cylon as belonging to the littoral belt as a whole, not only the small part which becomes dry during the neap tides, but also the reef-flat which is never laid dry. His paper shows that the conditoins for algal life there and on the Red Sea reefs as the author studied them, are in reality much the same. The tidal conditions on the West Indian reefs are similar to those of the Red Sea in having a small difference between high and low tides. The present writer, consequently, agrees with Boergesen (1915-20) in regarding the coral reef-flats as belonging to both belts

The lower limit of the sublittoral belt has been determined by Kjellman (1878) as the 20 fms. line, beyond which lies the littoral belt, This line may serve as a boundary in the southern seas, where light does not penetrate far; but in the Mediterranean and in the Red Sea, for example, luxuriant vegetation is found at about 40 fms. line. The lower limit may be taken, however, as the disappearance of algal vegetation, as determined by Rosenvinge (1899) and Cotton (1912).

The bottom of this belt differs in various places. Near the reefs it is sandy with or without broken shells and corals, the inner lagoon being of fine mud mixed with sand. Some sandy shallow areas of considerable extent have large scattered corals. Outside Abu Qalawa and Abu Fandir Reefs the bottom is rocky. Dredging and trawling, however, yield little in this locality.

3. *The Coral Reefs*

The Biological Station is separated from the open sea by three parallel lines of coral reefs, having a general direction of NNW to SSE, characteristic of the Red Sea. These chains may be divided as follows :

1. The inner chain or Abu Sadaf to Saad Reef.
2. The middle chain or Abu fanadir to Abu Qalawa Reef.
3. The outer chain or Umm Qamar to Abu Melana Reef.

From the above series of coral reefs, it is seen that the Station is well sheltered in a lagoon, the waves of which are more likethose of a lake than of the sea. Besides the above mentioned reefs there are the shore reefs and small reefs near shore.

Abu Sadaf reef is seen white or green according to height of the tides, showing that it is dead reef with a surface covered with sand except at edge where we get abundant algal growth, especially on the side facing the prevailing wind. The reef-flat itself is a good hunting ground for Caulerpa racemosa and Caulerpa serrulata. Dictyosphaeria cavernosa and Valonia ventricosa are attached to the dead corals, especially the former which is common and extends from the high water mark down to the sublittoral belt.

The Crescent reef being near to the laboratory and largely covered by sea-weeds in summer, has been thoroughly investigated. It is densely covered by Sargassum subrepandum-association, Cystoseira Myrica-association and Turbinaria decurrens-association on its NW horn. Cystoseira Myrica, which grows on the reef-flat just below low water mark is much stunted, in contrast to its longer growths on the shore reef between tide marks. The windward side of this reef offers the main growths of Sargassum and Dilophus associations. Towards the leeward side, the surface has numerous irregular crevices and miniature caves which shelter many species, especially the red algae which thus gain shelter from the direct blaze of the sun. In places on this leeward side, sand accumulates to the extension of Sargassum and the encouragement of Claulerpa racemosa. The reef edge, which is never dry, is peculiarly rich in vegetagion. Almost all the visible corals are associated with red and brown algae confined to such habitat. It is not the tough cartilaginous forms, which flourish in rough water, but the very delicate species, which offer no restance to the waves, such as Trichogloea Requienii.

In the Harbour reef, the crevices as well as the reef-flat are well covered with living corals unsuitable for the growth of Algae. Occasionally the upper parts of the corals die from being exposed at exceptionally spring tides. In a few days time, the dead portions begin to be covered with such forms as Enteromorpha clathrata, Ectocarpus sp., Cladophora prolifera and Sphacelaria tribuloides. This reef bears quantities of Turbinaria decurrens, which obtains a height of about 5 feet in autumn, but it is all washed ashore during the months of November, December and January. While the inner line of reefs has been thoroughly examined, yet the middle and the outermost lines have only been visited occasionally.

The most striking difference between the Red Sea shores and shores of all corals reef-seas and those of temperate countries is in the comparative inconsipicuous forms of the algae of the former. Great level areas of reefs are suddenly exposed by a fall of water of only a few inches, and the effect of the powerful sun on the areas above low water level is detrimental to all but a small forms. The biological conditions change sharply as we pass from these barren looking to water only a few inches deeper at their edges, where there being no exposure to the air, corals grow and with them a rich associated fauna and flora, but even here only Sargassum and Turbinaria decurrens are conspicuous. At Ghardaqa there are offshore reefs which, having lately reached the surface, are largely covered by growing corals and algae, so that this part of the sublittoral belt is locally drawn out into large area.

The littoral belt on the shore reef is not as barren as it appears at first sight. Though loose stones are generally absent and the rocky surface is covered by a thin layer of sand or mud, largely held in places by siphonocladoid growths, there is a considerable flora which is capable of withstanding not only the strong illumination but the extreme variation in temperature. Such shallow water may rise to 37°C on a summer day and sink to about 10°C at night in winter. Both in summer and winter the daily variations of temperature are large (Nasr 1955). The flora of the shallow pools on the shore reef-flats is therefore widely different from that of the edge of the reef which bathed by water of more constant temperature.

The algae living between tide marks are forced to undergo periods of submergence alternating with periods of almost complete dryness.

They are subject to alternate periods of relatively strong and weak illumination. Under this effect it is expected to find a rich algal flora in the lower littoral and upper sublittoral belts and this is shown in the following table :

A PRILIMINARY LIST OF ALGAE SHOWING THEIR LOCAL DISTRIBUTION WITH REGARD TO DEPTH

	Belts					
	Littoral			Sublittoral		
	0-50 cm.	50-100	100-120	0-20 m.	20-40	40-80
Chlorophycophyta						
Acetabularia Caliculus			+	+		
,, exigue				+		
,, Mobii				+		
Avrainvillea amadelpha				+		
Boodlea composita		+	+			
Bryopsis corymbosa			+	+		
,, plumosa				+		
Coulerpa crassifolia					+	
,, peltata				+		
,, racemosa			+	+	+	
,, scalpellifrmis					+	+
,, serrulata			+	+		
Chaetomorpha Linum		+	+			
Cladophora fascicularis		+	+	+		
,, gracillima		+	+			
Cladophoropsis Zollingeri	+	+	+			
Codium adhaerens			+	+		
Codium arabicum				+		
,, elongatum			+	+		
,, decorticatum			+	+		
Derbesia tenuissima				+		
Dictyosphaeria cavernosa		+	+	+	+	
,, intermedia v. solida				+		

	Belts					
	Littoral			Sublittoral		
	0-50 cm.	50-100	100-120	0-20 m.	20-40	40-80
Halimeda incrassata					+	
,, Opuntia		+	+	+		
,, Tuna		+	+	+		
Microdictyon Agardhianum				+		
Neomeris annulata			+	+		
Pseudobryopsis papillata						+
Rhipiliopsis aegyptiaca				+		
Sporocladopsis erythreae				+		
Tydemania Mabahithae					+	
Udotea argentea					+	
,, javensis				+		
Ulva fasciata				+		
,, lactuca			+	+		
Valonia aegagropila	+	+	+	+		
,, ventricosa				+		
Pseudovalonia Forbesii			+			
Valoniopsis pachynema				+		
Phaeophycophyta						
Colpomenia sinuosa		+	+	+		
Cystophyllum trinode		+	+			
Cystoseira Myrica	+	+	+	+		
Dictyopteris membranacea						+
Dictyota dichotoma			+	+		
Castagnea ramosissima			+			
Hormophysa triquetra			+	+		
Hydroclathrus clathratus			+	+		
Nereia filiformis				+		
Padina Pavonia	+	+	+	+		
Sargassum crispum				+		
,, latifolium				+		
,, subrepandum				+		
Spathoglossum variabile			+			

	Belts					
	Littoral			Sublittoral		
	0-50 cm.	50-100	100-120	0-20 m.	20-40	40-80
Sporochnus comosus						+
Turbinaria decurrens				+		
Zonaria Schimperi						+
„ variegata			+	+		
Rhodophycophyta						
Acanthophora Delilei		+	+			
Antithamnion Lherminieri				+		
„ pigmaeum						+
Botryocladia Chiajeana				+		
„ leptopoda						+
Callithamnion byssoides			+	+		
Callithamnion Hameli				+		
Capraella elegans		+	+			
Centroceras clavulatum		+	+	+		
Ceramium fastigiatum	+	+	+			
„ Nayali			+			
Champsia irregularis		+				
Chrysymenia ventricosa						+
Crouania attenuata				+		+
Dasya flocculosa		+	+			
Digenea simplex		+	+	+		
Endosiphonia clavigera			+	+		
Erythrotrichia carnea		+	+	+		
Galaxaura fragilis						+
„ lapidescens			+			
Gelidiella acerosa						
Gelidium pusillum	+	+	+			
Goniotrichum elegans				+		
Gracilaria arcuata			+	+		
„ foliifera			+			

	Belts					
	Littoral			Sublittoral		
	0-50 cm.	50-100	100-120	0-20 m.	20-40	40-80
Griffithsia tenius			+	+		
Haloplegma Duperreyi					+	
Halymenia floresia						+
Heterosiphonia Wurdemani			+	+		+
Herposipnonia tenella				+	+	
Hypnea musciformis			+	+		
Hpoglossum spathulatum				+		
Jania adhaerens		+	+	+		
„ rubens			+	+		
Laurencia obtusa				+		
„ papillosa		+	+	+		
Leveillea jungermannioides				+		
Liagora farinosa			+	+		
„ rugosa	+	+	+	+		
Lithophyllum Kaiserii				+	+	
Melobesia farinosa			+	+	+	
Nitophyllum punctatum				+		+
Platoma incrassata					+	
„ Pickeana						+
Pleonosporium Borreri			+	+		
Polysiphonia pulvinata			+	+		
Rhodochoton robustum				+		
Roschera glomerulata			+			
Sarconema furcellatum			+	+		
Spermothamnion investiens			+	+		
Spirocladia minor					+	+
Spyridia aculeata			+	+	+	
„ filamentosa		+	+	+		
Trichogloea Requienii				+		

III.— THE NATURE OF SUBSTRATUM AFFORDING DIFFERENT TYPES OF FORMATIONS

It is known that the algal formation is the major unit of vegetation. Each formation could be held as a complex and definite organic entity with a characteristic development. It is a product of the substratum and is largely controlled by it. A formation comprises a number of different associations. The algal association, referred to here, may be defined as an algal community characterised by its essentially homogenous physiognomy and ecological structure and by its homogenous floristic composition, at least with regard to dominant species.

Along the shore of the Red Sea in the neighbourhood of the Biological Station, the following different types of substrata can be distinguished :

1. Muddy and muddy sand substratum.
2. Sandy substratum.
3. Coral substratum.

In view of the different substrata along the Egyptian coast of the Red Sea, one can distinguish the following types of formations :

1. Muddy formation.
2. Sandy formation.
3. Coral formation.

1.—Muddy Formation

Among the Cyanophycophyta, there are some examples of algal associations growing in muddy shores e.g. Lyngbya, Oscillatoria and Phormidium associations. The algae living in this muddy habitat are characterised by the production of mucilaginous substance which acts in stabilising the mud through the adherence of its particles with the trichome-sheaths of the algae. These muddy places after being colonised by the Cyanophycophyta, and more or less stabilised are re-established by other algae. The colonial forms of some Cyanophycophyta such as Gomphosphaeria aponina and Chroococcus turgidus mark a characteristic association which is known from the muddy shores at Gaftoun and Abu Minqar Island, particularly the

western lee side between tide marks. Both species grow so luxuriantly that they give a blue tint to the substratum they inhabit.

There is a big area of muddy sand bottom at Abou Minqar swamp where the observer is generally met with the extensive growth of the mangrove-association, namely, Avicennia officinalis. In that locality little algal vegetation is likely to be met with, particularly some rare Cyanophycophytes e.g. Lyngbya sp. and Oscillatoria. This poverty in algal vegetation here may be due to the looseness of the substratum. The mangrove swamps in the Red Sea are extremely poor in algae in comparison with those of the true mangrove, Rhizophora mangle, in the West Indies, where accorindg to Boergesen (1915-20) there is a very luxuriant growth of algae.

2.—Sandy Formation

Just as the adjacent sandy formation of our Eastern Desert is not well developed, so, too, the algal sandy formation is not well produced. The sandy formation is, indeed, poor in the floristic composition of the different associations. A good example afforded by the sandy substratum is the Caulerpa-association in which C. racemosa is the dominant species in sheltered shores. Both C. racemosa and C. serrulata are characterised by decumbent growth forming stolons that give rise to an active formation of branched rhizoids. The rhizoids assist in fixing the plant firmly to this mobile substratum. The aerial parts of these algae are composed of assimilators with smooth surface that avoid accumulation of sand. The species entering in the formation of this association are mostly epiphytes of a small size, e.g. Ceramium sp. and Herposiphonia tenella.

Sandy bottom as usual offers an unsuitable substratum for the attachment of algae, but large sandy areas may be occupied for a considerable periods by growing algal association such as Hydroclathrus associatoin in which Colpomenia sinuosa and Enteromorpha crinita may take part. This association, as a matter of fact, begins life attached to dead corals from which they become later detached and sink to the bottom of an adjacent lagoon where it grows luxuriantly. The sandy lagoon in the Qalawa, for instance, is always in winter and spring, covered with immense quantities of three algae, namely, Hydroclathrus clathratus, Colpomenia sinuosa and Enteromorpha crinita. This habitat and mode of growth evidently form a regular stage in the life history and show a wandering association.

The lagoons in the vicinity of the Station generally have the bottom composed of sand mixed with little mud. In this locality a luxuriant growth of some phanerogams is to be met with, e.g. Holophila, Cymodocea, and Diplanthera-associations which are distinct in ecological structure and provide the collector with few algae growing as epiphytes e.g. Liagora elongata, Castagnea ramosissima, Schizothrix Nasri, Melobesia farinosa and Ceramium sp.

In the inner lagoon together with Cymodocea-association, the very crisped form of Sargassum crispum is a good example of the pelagic Sargassum-association, characterised by a dense covering of a certain encrusting red sponge, which hinders the normal growth of this alga.

3. Coral formation

This type of formation comprises most of our algal flora, especially those algae growing on the coral reef-flats. It gives a good picture of various types of associations in which the dominant species are characterised by a discoid basal attachment, capable, of holding the algae fast to the rock. In exposed localities the species are firmly attached by means of numerous rhizoids, which are generally well developed on rough surfaces.

The algal association differs greatly with regard to water immersion. In the littoral belt the following associations are recognised by the writer in this type of succession starting from the upper littoral belt.

A. LITTORIAL BELT.

1. Padina-Association.

The ecological aspect of this association is heterogenous with regard to the bionomical divisions. It is a rich and well developed association on the reef-flats below low water mark, but it may be poor in the floristic composition in the upper littoral belt in sheltered places. The ecological structure of this association is well controlled by the high temperature and intense light effect. From this point of view Padina Pavonia resists the high temperature and endures great desiccation during summer months at ebb-hours. The white colour and the feeble decoloured pigments of some algae present in this association are attributed mainly to the effect of strong light. This is clearly shown in Spyridia filamentosa and Laurencia obtusa and some other epiphytes of this association.

2. Liagora-Assosciation.

This association is characteristic of coral rocks mixed with broken shells in sheltered places. It occurs on the reef-flats rich in igneous pebbles to which Liagora rugosa is attached. The thallus of this species, being impregnated with soft calcareous substance affords such epiphytes and endophytes as Codiolum Petrocelidis, Endoderma sp., Phaeophila dendroides and Rhodochorton sp.

3. Laurencia-Association.

In the middle littoral belt near the Station, particularly on the shore reefs there is a big area covered with this association. The bottom in this place is remarkably composed of dead corals intermingled with black-shelled barnacles to which Laurencia obtusa and Laurencia papillosa are attached. This association is easily distinguishable at a long distance as a light yellowish brown community, because the individual algae are faded by the effect of the sun. The tough, cartilaginous character of these species probably makes this association well fitted for resisting both tidal waves and moderate desiccation. On the harbour reefs, just below low water marks the well developed Laurencia association may be found on the edges of these reefs.

4. Cystoseira-Association

Cystoseira Myrica, the prevailing species in this association together with some rare individuals of Cystophyllum trinode, are the only example of the Fucoideae which flourish in the beginning of the middle littoral belt. It occurs often in tide pools, where it can withstand high salinity and temperature.

5. Halimeda-Association.

This association is characteristic of exposed shores at Qoseir, with the dominating Halimeda Opuntia. It produces a good deal of calcareous deposits which take part in the shore reef formation. The following algae are observed.

Sargassum Subrepandum	(common)
S. latifolium	(frequent)

Laurencia papillosa	(rare)
L. obtusa	(common)
Padina Commersoni	(common)
Codium decorticatum	(fairly common)

6. *Digenea-Association.*

This is characteristic of the sheltered lower littoral belt at Ghardaqa. This association is typically presented by Digenea simplex and Jania rubens which are almost found together and which are about equally common. On account of their ample ramification and the dense compact growth, they look almost spongeous a fact which helps in retaining water by capillary action during lowest tides in summer. This association comprises the following epiphytes :

Jania rubens	(common)
Padina Pavonia	(uncommon)
Valonia aegagropila	(abundant)
Cladophoropsis Zollingeri	(rare)
Dictyosphaeria cavernosa	(rare)
Laurencia obtusa	(very common)
Valonia ventricosa	(common)
Caulerpa peltata	(very rare)

In certain instances the coral rock may be covered with a thin layer of sand which offers a favourable habitat for Ceramium and Pseudovalonia, characteristic of exposed shores.

B. SUBLITTORAL BELT.

1. *Sargassum-Association*

This association occurs on the reef-flats just below low water mark and extends down to about four fathoms. The pecular and characteristic Sargassum subrepandum-association is very common on the sheltered coral reefs and on the edges of the shore reefs. It is wide spread and covers great areas. It is well developed in structure and floristic composition. As a sub-vegetation to the Sargassum-Association, one may distinguish the following species :

Padina	(common)
Dilophus Fasciola	(uncommon)
Hormophysa triquetra	(abundant)
Sargassum asperifolium	(common)
S. latifolium	(rare)
Sphacelaria furcigera	(rare)
Halimeda Tuna	(uncommon)
Codium decorticatum	(very rare)
Herposiphonia tenella	(rare)
Griffithsia tenuis	(common)
Rhodochorton crassipes	(rare)

2. *Turbinaria-Association*

This association occurs somewhat below the lowest water mark The height, as a matter of fact, varies according to the exposure of the locality. It is often widely distributed in autumn and winter. The epiphytes common on Turbinaria decurrens forming this association are : Melobesia farinosa, Ectocarpus arabicus, Sphacelaria tribuloides, and Rhodochorton robustum, a species often forming a dense velvety covering on the peltate thallus of the fronds. In exposed localities the growth form of Turbinaria is stunted.

3. *Goniotrichum-Association.*

This association occurs in crevices on coral reefs below tide levels. It presents in some way helpful analogies with Peyssonnelia-association of the Mediterranean (Feldmann 1937). This point of view is specially stressed in relation to their floristic composition and to their ecological structure. Both associations are generally regarded as controlled by weak illumination. The soft structure and the ineffective attachment of the frond in this association do not maintain any substantial growth in exposed localities. Most species taking part in this association are of small size and rich in chromatophores. The present association comprises the folloiwng species :

Avrainvillea amadelpha	Callithamnion Hameli
Microdictyon Agardhianum	Botryocladia Boergesenii
Rhipiliopsis aegyptiaca	,, Chiajaena
Udotea javensis	Gracilaria arcuata
Valonia ventricosa	Galaxaura lapidescens
Valoniopsis pachynema	Hypoglossum spathulatum
Nereia filiformis	Lithophyllum incrustans
Melobesia farinosa	Myriogramme okhaensis
Peyssonnelia squamaria	Nitophyllum punctatum

4. *Lithophyllum-Association.*

Lithophyllum Kaiserii is the dominant species forming this association. It grows luxuriantly on reef-flats and reef edges below water marks. It takes a great part in the formation of some coral reefs. This association acts as a good substratum for the attachment of other algae. It is generally associated with some annilida and other boring animals and algae. In some places, particularly in the neighbourhood of Ashrafi, Lithophyllum incrustans is the dominant species at about 40 fathoms deep. The species characterising this association are :

Caulerpa scalpelliformis	Botryocladia leptopoda
Pseudobryopsis papillata	Chrysymenia ventricosa
Tydemania Mabahithae	Crouania attenuata
Dictyopteris membranacea	Haloplegma Duperreyi
Palmophyllum crassum	Halymenia floresia
Sporochnus comosus	Spirocladia minor

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DEUX POIDS FORTS OMAYYADES EN VERRE, DATES DE L'AN 88 H.

par

PAUL BALOG

Les documents métrologiques omayyades de la huitième et neuvième décade de l'Hégire sont tous fort rares. Les plus anciens poids connus sont deux jetons en verre du khalife ᶜAbdel-Malek, l'un au Cabinet des Médailles à Paris *(Lavoix I. p. XLV.)*, l'autre au Musée National Syrien à Damas *(Djᶜafar ᶜAbdel-Kader, Mélanges Syriens offerts à M.R. Dussaud, 1939)*. Un troisième poids en verre d'ᶜAbdel-Malek, d'un demi-ratl (175 grm 50) se trouve également au Musée National à Damas *(Djᶜafar ᶜAbdel-Kader, Berytus II. 1935, pp. 139-140)*. Les deux premiers jetons ne portent pas d'indication de date, peuvent donc provenir de n'importe quelle année entre la reforme d'ᶜAbdel-Malek en 77 H. et 86 H., année de sa mort. Le poids fort au contraire, présente conjointement au protocole du khalife celui de son fils et héritier, Walid premier. Ce prince fut proclamé héritier en l'an 85 H. seulement, il est donc évident que le poids fut émis en 85 ou 86 H.

Bien qu'il présente une importance capitale pour la métrologie musulmane, le poids monétaire en bronze de Hajjaj ben Youssef publié par Walker ne présente aucun point de repère permettant de le dater, même de façon approximative. Hajjaj était en fonctions de 77 à 95 H., aussi ce poids a pu être émis n'importe quelle année de son activité.

Les jetons, poids et estampilles en verre provenant du règne de Walid 1er et qui portent le nom de Kurrah ben Charik, ne sont point datés; mais il est évident qu'ils ont été fabriqués entre 90 et 96 H.

Le plus ancien poids musulman en verre explicitement daté connu jusqu'à ce jour est un jeton anonyme de l'année 96 H. *(British Museum Cat. of Glass-weights by Lane-Poole, p. XXVII. i.)*. Dès le début du deuxième siècle de l'Hégire les documents deviennent plus fréquents; plusieurs pièces datées et d'autres dont la date peut être fixée par les légendes, sont connues, entre autres des poids forts.

Comme on le voit, chaque nouveau document constitue une acquisition précieuse à la série restreinte des poids et estampilles de l'époque archaïque islamique. C'est pourquoi nous sommes heureux de présenter deux poids datés de l'an quatre-vingt-huit de l'Hégire. L'un des deux est presque entièrement conservé, mais la lecture des inscriptions partiellement écaillées est imparfaite. De l'autre poids seulement un gros fragment existe; imprimé avec le même coin il présente des légendes parfaitement conservées. Les deux documents se complètent admirablement l'un par l'autre.

1. — Bloc en verre oblong, irrégulier, haut de 65 mm., large de 66 mm. et épais de 42 mm. Trou de suspension percé dans le sens de l'épaisseur. Un gros mamelon central sur la face supérieure indique le point de la coulée, flanqué de l'impression d'un cachet oblong profond, transversal, présentant des légendes; 20 mm. sur 24 mm.



Fig. 1

Le verre est dévitrifié, écaillé, tendre et mal brassé, d'une couleur jaune-pâle, sale, grisâtre, presque partout opaque, sauf quelques points translucides. Plusieurs petits éclats manquent, il y a aussi quelques écaillures mais le poids total ne semble pas avoir diminué de façon importante.

Ce verre provenant d'une fonte incomplète, faute de chaleur, plein de crasses, souillures et bulles d'air, est comme déjà mentionné d'une couleur jaune-pâle caractéristique; il ressemble aux verres coptes fabriqués durant les premières années de l'occupation arabe de l'Egypte. Les rares jetons et poids du khalife 'Abdel-Malek semblent avoir tous cette même teinte. C'est pourquoi le poids actuel semblait de prime abord appartenir à une haute époque. Les inscriptions du cachet ont confirmé cette première impression.

Légende sur trois lignes horizontales dont la première a presque totalement disparu à cause d'une écaillure:

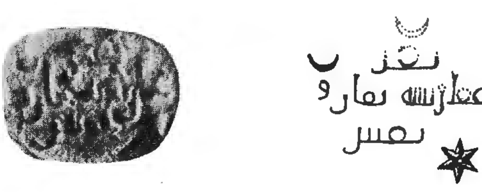


Fig. 2

Poids actuel: 291 grm. 60

La légende est claire: nous sommes bien en présence d'un poids daté de quatre-vingt-huit de l'Hégire.

Technique de manufacture: Marcel Jungfleisch a été le premier à reconstruire le processus de fabrication des poids parallélipédiques (ring-weights de Miles). *F.R. Matson* dans "*Early Arabic Glass Weights*" de *Miles*, p. 42, décrit le mode de fabrication de la même façon: "Glass could be poured in the form of a strip, bent into shape around an angular core, and then impressed with a stamp".

En effet, un mamelon central de la face supérieure indique le point de coulage sur l'exemplaire complet de l'an 88 H. Le verre semi-liquide fut étiré en ruban, ensuite, devenu pâteux il fut replié autour d'une barre métallique. Les deux bouts du ruban furent alors repliés l'un sur l'autre et pressés avec le bout d'une autre baguette. Grâce à la fusion incomplète du verre de notre poids entier on remarque clairement les deux bouts de ruban pliés et collés l'un sur l'autre, ainsi qu'une dépression assez profonde au milieu de la base, laissée par la deuxième baguette.

2. — Un heureux hasard nous a permis d'étudier un deuxième exemplaire de ce document extraordinaire. Ce fragment important (il pèse encore dans son état actuel 105 grammes) a été meulé postérieurement en forme d'un bloc oblong, long de 55 mm., haut de 26 mm. et épais de 35 mm. Ses surfaces dépolies et sa forme indiquent nettement qu'on a essayé de lui donner un aspect de pièce intacte. Il est vrai que la pièce est sans valeur au point de vue métrologique mais elle est importante à cause de la légende du cachet qui est de conservation parfaite. L'inscription du cachet est la même que sur le poids précédent. Il est donc aisé de reconstruire la lecture précise de la ligne supérieure manquante au premier exemplaire :

Empreinte: légende sur trois lignes horizontale.





Fig. 3.

Diam. du cachet: 17 × 26 mm.

Un croissant au dessus de la lettre centrale de la première ligne, un autre croissant au dessus de la dernière lettre de la deuxième ligne et une étoile à six branches à droite en bas.

Le verre est jaune clair un peu fade, tendre mais assez homogène et translucide, peu crasseux. Quelques petites bulles d'air. La pièce a été chauffiée suffisamment pour complèter la fusion, contrairement au poids précédent.

Les deux poids que nous venons de décrire sont, à notre connaissance, les plus anciens poids en verre arabes datés. Bien qu'anonymes, leur date de 88 H. établit qu'ils ont été émis par le gouverneur d'Egypte 'Abdallah ben 'Abdel-Malek ben Marwan (84-90 H.) sous le khalife Walid 1er ben 'Abdel-Malek (86-96 H.).

Ils sont une preuve formelle que les poids parallélipédiques (ring-weights de Miles) ont déjà existé à cette époque.

Epigraphie. Tous les poids et estampilles en verre omayyades présentent des légendes écrites en coufique archaïque d'un style assez lourd, aux traits épais. Leur calligraphie primitive est caractéristique.

Au contraire, ces deux poids de l'an 88 de l'Hégire portent des légendes finement gravées d'un style élégant et sûr, aux caractères coufiques minces et élancés, la tête des lettres bifides: elles ressemblent fortement aux inscriptions des dirhems omayyades frappés à Wasit.

Métrologie. Les éclats et écaillures ont dû quelque peu diminuer le poids original de notre exemplaire No. 1.; mais son assez bon état fait augurer une perte approximative de dix à vingt grammes seulement (c'en est plutôt une conjecture qu'une estimation !). Il ne semble pas appartenir au système pondéral musulman du ratl, car le ratl discoïde parfaitement conservé de la "Walters Art Gallery" de Baltimore pèse 337 grammes 55 (126 A.H.); le demi-ratl du khalife ʿAbdel-Malek du Musée National Syrien à Damas est encore plus lourd : 175 grm. 50 ce qui correspond à 351 grm. pour le ratl entier. Le ratl de la coll. Fouquet, de l'an 119 H., pèse 431 grm. 87. Le poids de 291 grm. 60 de notre *thikl* est donc sensiblement inférieur à celui des plus légers des ratls connus. Il paraîtrait plus vraisemblable qu'il appartienne encore au système pondéral byzantin que les conquérants arabes ont adopté au début de la conquête. Les poids byzantins continuèrent à servir, d'abord dans leur état original, ensuite avec des inscriptions en arabe surajoutées en guise de validation : Miles a publié un poids circulaire en bronze, d'émission byzantine, déclaré valide pour deux okiyyehs par Walid 1er. Ce poids de double okiyyeh est composé de deux okiyyehs de 26 grm. 80, ce qui fixerait le poids de son *ratl* à 321 grm. 60., chiffre lui aussi, inférieur au poids du ratl musulman.

Il n'est pas impossible que même après l'introduction d'un nouveau système pondéral islamique, l'ancien système byzantin continua à être utilisé pendant assez longtemps, parallèlement avec les nouveaux poids. Nous croyons en voir la preuve dans le poids publié par Miles : Walid 1er règna de 86 à 96 H., son exemplaire est donc contemporain ou même plus récent que notre poids en verre de 88 H. Un autre document probablement plus tardif encore, s'ajoute au précédent : un double cône tronqué en bronze (diam. aux bases 12 mm., diam. au milieu 21 mm., hauteur 15 mm.) de 27 grm. 29; la base porte le mot عدل finement gravé en caractères coufiques allongés. La face supérieure présente le mot عشرة en écriture de style identique à celui de la base. Bien qu'anonyme, le style des légendes place ce poids au début de l'époque abbasside, on pourrait donc conclure que l'objet a été fabriqué quelque temps vers le milieu du

deuxième siècle de l'Hégire. Son poids se rapproche plus ou moins exactement de celui de l'once byzantine, et non pas de celui de l'okiyyeh.

Le poids actuel de notre exemplaire No. 1. de 291 grm. 60, — tout en admettant une perte de substance de 20 ou même de 25 grammes, — paraît se rapprocher de celui de la livre byzantine de 317 grm. 808. C'est probablement la raison pour laquelle notre poids porte l'indication de ثقل et non pas celle de ratl; exception sans précédent jusqu'à ce jour dans le corpus des poids musulmans.

Au premier abord, si l'on s'arrête au style de l'écriture, on serait tenté d'attribuer une date plus récente à ces poids. Mais la lecture est trop claire pour qu'on puisse avoir le moindre doute à son sujet. De plus, à cette époque il existe de nombreux documents épigraphiques d'une calligraphie aussi évoluée qui viennent apporter une confirmation. Ainsi, comme mentionné ci-haut, les dirhems omayyades de Wâsit sont gravés avec des caractères qui ressemblent parfaitement à ceux de nos poids. Il est permis de supposer que la matrice avec laquelle les deux thikls furent imprimés, aurait été gravée non par un artisan de verre, mais par un graveur de monnaies ayant travaillé pour l'atelier de Wâsit.

Résumé

Description de deux poids en verre datés de 88. A.H.
Les poids forts parallélipédiques ont déjà existé à cette date.
Le système pondéral byzantin paraît avoir survécu encore durant une assez longue période à coté du système pondéral islamique.
Dénomination : probablement indiquant que le poids appartient encore à l'ancien système.

Spectrographic Distribution of Chemical Elements in Egyptian Minerals from Lead, Zinc, Copper and Gold Deposits (1)

by

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ABSTRACT

The distribution of Chemical Elements in some Egyptian minerals including galena, sphalerite, chalcopyrite, chalcocite, pyrite, "calamine", arsenian wulfenite and goslarite from well known mineralizations of Lead, Zinc, Copper and Gold was determined by comparative spectrographic analysis using a Hilger Littrow spectrograph. Conclusions regarding the genesis and temperature of formation of the mineral deposits examined were reached by comparing the data obtained and previous work on the geochemistry of some mineralizations in foreign countries.

INTRODUCTION

The great majority of minerals contain minor quantities of chemical elements in addition to their major constituents. In many cases, especially in the sulphides, the minor elements were found to be related to several geological factors such as the metallogenetic epoch, temperature of deposition, mode of origin, etc. Furthermore several of these minor elements such as Ge, Ga, In, Ag, Cd, etc. are assuming some economic value and the knowledge of the factors favourable for their deposition is gaining increasing importance in the science of economic geology.

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In the present study spectrographic analysis of several minerals from known localities of Lead, Zinc, Copper and Gold mineralizations in Egypt was carried out. The analyzed minerals include galena, sphalerite, chalcopyrite, chalcocite, pyrite, "calamine", arsenian wulfenite and goslarite. The purpose of this study is to know the distribution of chemical elements in these minerals, especially those of economic interest, and to relate the minor elements assemblage to the genesis and mode of formation of the deposits from which these minerals were collected.

Previous work on most of the above minerals from other foreign countries has revealed the relation of the chemical elements present and several factors of geological significance. The correlation of the results reached in the present work with those of previous workers on this subject, helped the authors to reach conclusion regarding the physicochemical conditions of deposition and mode of origin, etc. of the examined mineral deposits.

De Launay and Urbain (1910) suggested that the main factor determining the contents of minor elements in sphalerite was the composition of the primary medium of crystallization, which was in turn dependent on the metallogenetic epoch and the depth of vein formation.

Goldschmidt and Peters (1933) found that Ge is concentrated in low temperature sphalerites, while Papish and Stilson (1930) recorded that Ga is lower in secondary zinc minerals as compared to primary hypogene sphalerite.

Graton and Harcourt (1935) have noted the similarity of the minor elements content of sphalerite in ores from five regions of accepted magmatic origin and in those of the Mississippi Valley type, and accordingly concluded that the latter type of deposits are also of magmatic origin and not formed by meteoric waters.

The works of Stoiber (1940) on sphalerite from many parts of the world, Oftedal (1940) on Norwegian sulphides, Prokopenko (1941) on sulphides from the USSR and Gabrielson (1945) on Swedish sphalerites emphasized the effect of temperature and the chemical character of the ore bearing solutions in each metallogenetic province on the distribution of minor elements.

Carstens (1944) was able to distinguish between sedimentary and hydrothermal pyrites by means of relative spectrographic analyses of Norwegian pyrites. He found that hydrothermal pyrites contain a greater number and larger quantities of trace elements than those of sedimentary origin.

El Shazly (1951) by semiquantitative and comparative spectrographic analysis of a considerable number of sphalerites, galena and associated sulphides, oxidation products and gangue minerals, found that the trace element content in individual minerals was governed by the following factors

1. Temperature of formation
2. Regional conditions of deposition
3. Mode of origin whether epigenetic or syngenetic
4. Supergene oxidation.
5. Conditions of deposition affecting mineral textures.

METHOD OF ANALYSIS

Preparation of the samples.

Small amounts of the minerals under consideration were separated under a binocular microscope by a steel needle. Although great care has been taken in the separation of the samples, however, in some cases contamination was unavoidable. For example, the sphalerite from Samuiki contains very fine grains of chalcopyrite which are almost impossible to separate by the needle. Some impurities in the minerals collected from the oxidation zone also could not be separated.

After thorough grinding in an agate mortar cleaned with aqua regia, the sample was ready for analysis.

Spectrographic technique and apparatus

A high dispersion spectrograph of the Littrow type was used With this instrument the spectrum can be examined between 1910 A

to 8000 A and the length of the spectrogram between 2000 A and 8000 A is approximately 67 cm. The total length of the spectrum of such a big dispersion instrument has to be taken in three ranges on separate plates. For the present work only two ranges of wave length were required for analysis, the first ranging from 2400 A to 3350 A and the second from 3150 to 8000 A. The slit of the spectrograph was kept constant at a width of 0.015 mm.

Spectrochemically pure carbon electrodes of diameter 5 mm and 5 cm. long were used. A boring 1.2 mm. in diameter and 1 cm. deep was made in one of the electrodes. To ensure adequate filling of the boring, the electrode was tapped many times while the mineral powder was introduced.

The electrodes were held in a Gramont arc stand, the lower electrode containing the sample being the anode. An input of 110 volts and a direct current of 8 amps were used. An enlarged focused image of the arc was projected on the slit of the spectrograph by means of a quartz lens, the magnification being four times the length of the arc gap which was 8 mm. The middle of the gap was adjusted to cover the exposed part of the slit through the Hartmann diaphragm. Two exposures were taken for every sample, the first being 35 seconds; then the shutter was closed for 5 seconds while the Hartmann diaphragm was moved to the following position and the second exposure 80 seconds. Before taking the spectrum of the sample, an iron arc spectrum was taken to use in the qualitative interpretation of the spectrograms. All the spectra were recorded on Ilford long-range spectrum plates. After taking the spectra the plates were kept for six minutes in the developer (D19B) and fixed in acid hypo for 20 minutes, then washed for an hour and a half in running water. All the samples were subjected to identical conditions of excitation and photographic recording.

Interpretation of the Spectrograms

The spectrograms of the minerals examined were interpreted under high magnification (X25). The following elements were sought for in the spectrograms : Ag, Al, As, Au, Ba, Bi, Ca, Cd, Co, Cr, Cu, Fe, Ga, Ge, Hg, In, Mg, Mn, Mo, Ni, P, Pb, Sb, Si, Sn, Sr,Ti, Tl, V, W and Zn. The concentration of the elements was determined

from the relative intensities of the spectral lines listed in table. These relative intensities are expressed by the following symbols :

—	Not detected
1	Very faint line
2	Visible line
3	Medium line
4	Fairly strong line
5	Strong line
6	Very strong line
M	Main constituent

Six elements including Ga, Hg, In, P, Tl and W were not detected in any of the samples analyzed. The elements sought are arranged in Table II according to the Long Period System.

TABLE I

Wave length of the spectral lines of elements used in the present work

Element.	Wave length of spectral lines used in analysis (A)		
Ag	3280.7	3382.9	
Al	3092.7	3944.1	3961.5
As	2780.2	2860.5	
Au	2428.0	2676.0	3122.8
Ba	4554.0	4934.1	
Bi	2898.0	3067.7	
Ca	3933.7	4226.7	
Cd	2980.6	3261.1	3403.6
Co	3405.1	3453.5	3465.8
Cr	4254.3	4274.8	
Cu	3247.5	3274.0	
Fe	3020.489	3020.640	
Ga	2874.2	2943.6	
Ge	2651.2	2651.6	3039.1
Hg	2536.5		
In	3256.1	3258.6	
Mg	2802.7	2852.1	
Mn	4030.8	4033.1	4034.5
Mo	3132.6	3170.3	3194.0
Ni	3050.8	3414.8	3524.5
P	2535.7	2553.3	2554.9
Pb	2833.1	3683.5	
Sb	2598.1	3232.5	3267.5
Si	2516.1	2528.5	2881.5
Sn	2840.0	3175.1	3262.3
Sr	4077.7	4215.5	4607.3
Ti	3349.4	3361.2	
Tl	2767.9	2918.3	
V	3183.4	3184.0	3185.4
W	4008.8	4294.6	
Zn	3282.3	3302.6	3345.0

DISCUSSION OF THE ANALYTICAL RESULTS

Minerals from the following mineralizations (Plate I) were analyzed.

1.—Lead zinc mineralizations in Miocene sediments on the Red Sea. Minerals from six localities were analyzed, these include galena from Quseir, Zug El Bohar, Abu Anz, Um Gheig, Gebel Rusas and Ranga; "calamine" and arsenian wulfenite from the oxidation zone of Um Gheig.

2.—Zinc copper deposit in Pre-Cambrian igneous - metamorphic complex at Samuiki in the South Eastern Desert.

Three minerals were analyzed from this locality including sphalerite, chalcopyrite and goslarite. The first two minerals are primary and the second formed by supergene oxidation of sphalerite and to a lesser extent chalcopyrite.

3.—Copper mineralization in fractures in Pre-Cambrian igneous and metamorphic rocks at Abu El Nimran, Sinai.

Only one mineral from this locality was analyzed namely chalcocite.

4.—Gold mineralizations in quartz veins cutting the Pre-Cambrian igneous metamorphic complex in the Eastern Desert.

Sphalerite, galena and pyrite were analyzed from Fawakhir gold mine and only galena from Abu Dabbab.

Lead Zinc Mineralizations in Miocene Sediments

Galena

Six samples of galena were analyzed spectrographically from the following localities : Quseir, Zug El Bohar, Abu Anz, Um Gheig, Gebel Rusas and Ranga. Twelve elements were detected in these samples which include Mg, Ca, Ti, Mo, Fe, Cu, Ag, Zn, Al, Si, Sn, and Pb (main element). Of these Ca, Fe, and Al are always present while Cu and Si are very comomn. On the whole these galenas are characterized by the absence or rare occurence of the elements enriched under high and moderate temperature of formation.

According to Oftedal (1940) and El Shazly (1951) the elements Bi, Sb, Sn, Ag and Mn increase with increasing the temperature of deposition of galena. Of these elements Bi, Mn and Sb were not detected in any of the samples analyzed while Ag and Sn are rarely present as small traces. These facts indicate that the galena is formed at very low temperature specifically below the leptothermal range.

"Calamine"

"Calamine" ore from Um Gheig oxidation zone is probably a mixture of several minerals including zinc carbonate, silicate and oxide which are present in variable proportions with carbonate (smithsonite) predominating. The following elements were detected in the analyzed sample : Mg, Ca, Sr, Ti, Mo, Mn, Fe (main element), Cu, Zn (main element), Cd, Al, Si and Pb. It is important to mention that the oxyphilic elements (those with affinity to oxygen) Mg, Ca, Sr, Ti, Mo, Al and Si are enriched in "calamine". Elements belonging to the hydrolyzates which are Mn and Fe are also enriched due to their fixation as insoluble hydrated oxides during the oxidation process.

Arsenian Wulfenite

A sample of this mineral in the form of small orange coloured crystals from Um Gheig shows the presence of a great variety of elements including Mg, Ca, Sr, Ba, Ti, V, Cr, Mo (main element), Mn, Fe (main element), Cu, Zn, Al, Si, Pb (main element) and As (main element). This mineral like others in the oxidation zone is characterized by the abundance of the oxyphilic elements and the hydrolyzates. Furthermore, marked enrichment in Mo, and As; and to a less extent V and Cr is noted. This is due to the formation of insoluble lead arsenate, vanadate and chromate all of which are isomorphous with the host mineral lead molybdate. If this mineral is found in appreciable amounts at Um Gheig or in any other locality it may be used as a source of Mo and probably As.

Zinc Copper Deposit at Samuiki

Sphalerite

A sample of sphalerite from Samuiki was analyzed spectrographically and it shows the presence of the following fifteen elements Mg, Ca, Mo, Mn, Fe, Co, Cu, Ag, Zn (main element), Cd, Al, Si, Ge, Sn and Pb. According to some authors including Stoiber (1940), Oftedal (1940) and El Shazly (1951) the elements Mn, Sn and In increase in sphalerite with increasing temperature of deposition while Ge, Ga and Sb decrease. Hence, the presence of small trace of Sn and moderate trace of Mn which are high temperature elements; and the detection of a small trace of Ge and the probable presence of Ga both are characteristic of a low temperature of deposition, indicate that sphalerite from Samuiki is formed at moderate temperature.

Furthermore the sphalerite is characterized by the presence of appreciable Cd. A comparison of the lattice parameters of ZnS and CdS both possessing the sphalerite crystal structure type show how isomorphism is readily possible :

Compound	Lattice Parameter A
Zn S	5.412
Cd S	5.82

On the same basis the presence of Mn may be explained. The high amount of Cu in sphalerite may be partly due to the presence of small grains of chalcopyrite.

Chalcopyrite

Eleven elements were detected in a sample of chalcopyrite from Samuiki which are Mg, Ca, Ti, Mn, Fe (main element), Cu (main element), Ag, Zn, Al, Si and Pb. It may be noted that Ag is present in both sphalerite and chalcopyrite from Samuiki. The high content of Zn may be partly due to the presence of mechanical impurities of sphalerite in chalcopyrite. El Shazly (1951) detected In and Sn in high temperature chalcopyrite and Ge in the low temperature mineral. All these three elements were not detected in the sample from Samuiki thus giving an indirect evidence of moderate conditions of deposition.

Goslarite

A sample of goslarite formed by supergene oxidation of the primary minerals at Samuiki especially sphalerite was analyzed giving the following elements; Mg, Ca, Ti, Mn, Fe, Ni, Cu, Zn (main element), Cd, Al and Pb. Compared to the original sphalerite the goslarite is impoverished in the thiophilic elements (with affinity to sulphur) which are Ag, Co and Cd, and enriched in oxyphilic

elements as Mg, Ca and Ti. The presence of high quantity of Cu may be explained by the substitution of Cu for Zn in goslarite and of an appreciable amount of Mg by the isomorphism of goslarite Zn $SO_4.7H_20$ and Mg $SO_4.7H_20$.

Copper Mineralization at Abu El Nimran, Sinai

Chalcocite

Abu El Nimran copper ores are formed of chalcocite associated with secondary minerals including covellite, cuprite and malachite. Chalcocite was analyzed in order to know its origin whether primary or secondary like the other associated minerals.

Spectrographic analysis of a sample of Abu El Nimran gave the following elements : Mg, Ca, Ti, Mo, Fe, Cu (main element), Ag, Zn, Al, Si, Sn, Pb and Bi. The presence of such elements as Bi, Sn and Mn is of especial significance since these are characteristic of sulphide deposits of primary mesothermal and hypothermal origin. However, the presence of these elements as moderate traces indicate the primary deposition of chalcocite by mesothermal solutions.

Gold Mineralizations in quartz veins in the Eastern Desert.

Minerals from two widely seperated gold mines in the Eastern Desert were analyzed. Three minerals which are sphalerite, galena and pyrite were analyzed from Fawakhir mine and only galena from Abu Dabbab.

Galena

A sample of galena from Fawakhir contain fourteen detectable elements which are Mg, Ca, Fe, Cu, Ag, Au, Zn, Al, Si, Sn, Pb (main element), As, Sb and Bi. The mineral shows the presence of appreciable amounts of Ag and some Au and As which seems to be the characteristic elements of Fawakhir mineralization. Moreover, the presence of moderate traces of Bi, Sb and Sn indicates mesothermal conditions of deposition.

Another galena sample was analyzed from Abu Dabbab gold - bearing quartz vein where the following elements were detected : Mg, Ca, Fe, Cu, Ag, Al, Si, Sn, Pb (main element), Sb and Bi. The presence of Ag, Sn and Bi indicates mesothermal deposition though somewhat shallower than Fawakhir.

Sphalerite

The following thirteen elements were detected in a sphalerite sample from Fawakhir : Ca, Mg, Fe, Mn, Co, Cu, Ag, Au, Zn (main element), Cd, Si, Pb and As. Cd is present in higher amount than in Samuiki sphalerite while Cu, Ag, Au and As are also present as in the galena from Fawakhir. The low temperature elements which are Ge, Ga and Sb were not detected in the analyzed sample while Mn which increases with temperature was found as a small trace.

Pyrite

Twelve elements were found in pyrite from Fawakhir which include : Mg, Ca, Mn, Fe (main element), Cu, Ag, Au, Al, Si, Pb, As and Bi. This further confirms that Fawakhir mineralization is characterized by the occurence of Cu, Ag, Au, and As. It is expected that gold is found as very minute grains in the sulphides from Fawakhir.

CONCLUSIONS

The following conclusions were reached regarding the distribution of chemical elements in minerals from lead, zinc, copper and gold deposits and its bearing on the genesis of these deposits.

1.—The analysis of galena samples from lead zinc deposits in the Miocene at the Red Sea indicates that they were formed at very low temperature. The galenas are characterized by the rarity or absence of Ag, Sb, Bi, Sn and Mn.

2.—Results of the analysis of sphalerite and chalcopyrite from Samuiki zinc copper mineralization show deposition at moderate temperature. The sphalerite is characterized by the presence of Mo, Mn, Co, Cu, Ag, Cd, Sn and Ge and chalcopyrite by Ti, Mn and Ag.

3.—Data on the chemical constitution of chalcocite from Abu El Nimran at Sinai helped to solve the problem of origin of this deposit as it proved that the mineral analyzed is of primary origin

being deposited in the mesothermal range. Characteristic elements present in the chalcocite are Ti, Mo, Ag, Zn, Sn, Pb and Bi.

4.—The gold mineralizations of Fawakhir and Abu Dabbab were formed at the mesothermal range of temperature, the former being deeper seated than the latter. Fawakhir minerals all show the presence of Ag, Au, Cu, and As. The galena sample from Abu Dabbab is characterized by the presence of Cu, Ag, Sn and Bi.

5.—Minerals from the oxidation zone at Um Gheig and Samuiki mines are rich in the oxyphilic elements and the hydrolyzates and in the meantime poor in the thiophilic group of chemical elements.

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TABLE II

ANALYTICAL RESULTS

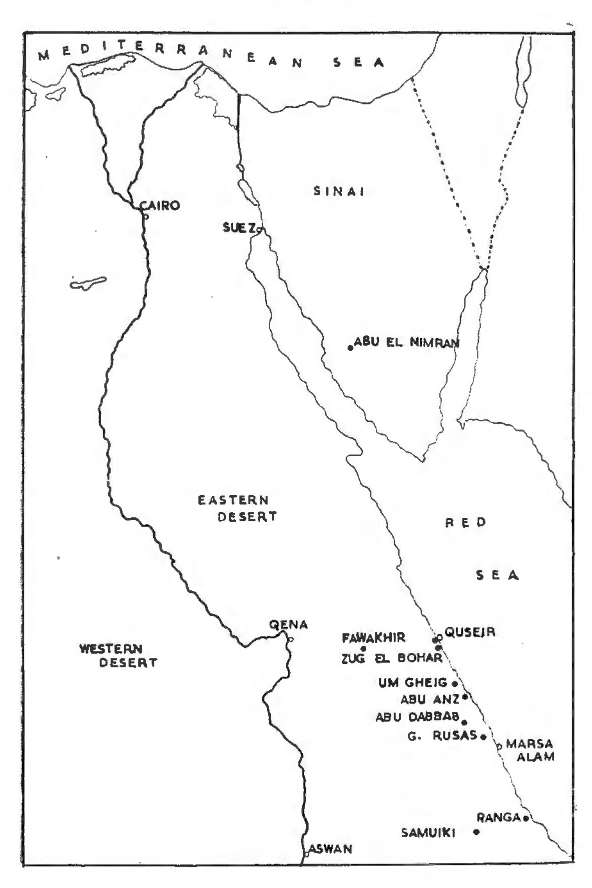
Mineral	*Locality*	*Mg*	*Ca*	*Sr*	*Ba*	*Ti*	*V*	*Cr*	*Mo*	*W*	*Mn*	*Fe*	*Co*	*Ni*	*Cu*	*Ag*	*Au*
Galena	Quseir	2+	2	—	—	—	—	—	—	—	—	2	—	—	1	—	—
Galena	Zug El Bohar	2	2	—	—	—	—	—	1+	—	—	2—	—	—	1—	1	—
Galena	Um Gheig	2	2	—	—	—	—	—	—	—	—	2	—	—	2	—	—
Galena	Abu Anz	3	2	?	—	2	—	—	1	—	—	3—	—	—	2+	1+	—
Galena	Gebel Rusas	2	2	—	—	2	—	—	—	—	—	2	—	—	1	—	—
Galena	Ranga	1	2	—	—	—	—	—	—	—	—	1	—	—	?	—	—
Galena	Fawakhir	1	2	—	—	—	—	—	—	—	—	3	—	—	2+	5	1—
Galena	Abu Dabbab	2	2	—	—	—	—	—	—	—	—	2+	—	—	2	3	—
Sphalerite	Fawakhir	1	2	—	—	—	—	—	—	—	1	3	2	—	2	2	1
Sphalerite	Samuiki	2	1	—	—	—	—	—	1	—	2	2+	2		4	2	—
Chalcopyrite	Samuiki	2	2	—	—	2	—	—	—	—	1+	M	—	—	M	2	—
Chalcocite	Abu El Nimran	1	2	—	—	2	—	—	1	—	2	2+	—	—	M	2+	—
Pyrite	Fawakhir	2	4	—	—	—	—	—	—	—	1+	M	—	—	2	2	1+
"Calamine"	Um Gheig	5+	3	1	—	2	—	—	2	—	2	M	—	—	2+	—	—
Wulfenite	Um Gheig	2	3	2	2	2	3	3	M	—	2	M	—	—	2	—	—
Goslarite	Samuiki	5+	3	—	—	2	—	—	—	—	2+	2	—	1+	6	—	—

ANALYTICAL RESULTS (*contd.*)

Minerals	*Locality*	*Zn*	*Cd*	*Hg*	*Al*	*Ga*	*In*	*Tl*	*Si*	*Ge*	*Sn*	*Pb*	*P*	*As*	*Sb*	*Bi*
Galena	Quseir	1-	—	—	2	—	—	—	1	—	2	M	—	—	—	—
Galena	Zug El Bohar	1	—	—	2	—	—	—	1+	—	2-	M	—	—	—	—
Galena	Um Gheig	3	—	—	1	—	—	—	1	—	—	M	—	—	—	—
Galena	Abu Anz	1	—	—	3	—	—	—	1+	—	—	M	—	—	—	—
Galena	Gebel Rusas	—	—	—	1	—	—	—	1	—	—	M	—	—	—	—
Galena	Ranga	—	—	—	1	—	—	—	—	—	—	M	—	—	—	—
Galena	Fawakhir	2	—	—	3	—	—	—	3	—	1	M	—	2	2	2
Galena	Abu Dabbab	—	—	—	2	—	—	—	2	—	2	M	—	—	1+	1+
Sphalerite	Fawakhir	M	3	—	—	—	—	—	2	—	—	2	—	2	—	—
Sphalerite	Samuiki	M	3-	—	2	?	—	—	2	1-	1	2	—	—	—	—
Chalcopyrite	Samuiki	5	—	—	2	—	—	—	5	—	—	2	—	—	—	—
Chalcocite	Abu El Nimran	4	—	—	1	—	—	—	2	—	—	2	—	—	—	2+
Pyrite	Fawakhir	—	—	—	1	—	—	—	2	—	—	5	—	1+	—	1+
"Calamine"	Um Gheig	M	1+	—	3	—	—	—	4	—	—	5	—	—	—	—
Wulfenite	Um Gheig	5	—	—	3	—	—	—	4	—	—	M	—	M	—	—
Goslarite	Samuiki	M	1+	—	3	—	—	—	2	—	—	2-	—	—	—	—



PLATE I



Scale 1 : 8,000,000

Map of the Eastern Part of Egypt showing the localities of the minerals analyzed.

Physiological Significance of Resistance and Susceptibility to Fusarium Wilt of some Egyptian Cotton Varieties:

(II) Effect of Fungal Metabolites on Cotton Vigour and Mode of Penetration (1)

by

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INTRODUCTION

In a previous paper (Mostafa and Naïm 1954), one aspect of host-parasite relationship, between the susceptible "Giza 26" and the resistant "Karnak" cotton varieties on one hand and *Fusarium solani* Sensu Snyder and Hansen on the other hand, has been elucidated. This was concerned with the responses of *Fusarium* mycelial growth and conidial germination to root metabolites as influenced by both the experimental cotton variety as well as the nature of the media on which seedlings have been raised. In the present paper, another physiological factor—operating during the prepenetration phase—will be studied, namely the effect of *Fusarium* metabolites on seedling vigours as influenced by the experimental cotton variety. The disturbance in the host-parasite balance, due to the possible role played by the fungal metabolites, might influence the host vigour in such a way as to cause either an increase or a decrease in its relative resistance or susceptibility. So far as the available literature indicates, a few work has been carried out to test the host vigour

(1) Communication présentée en séance du 14 mars 1955.

responses—compared in the resistant and susceptible varieties — to the rhizospheric metabolites of the causal fungal pathogen. Litzenberger (1949) found that *Helminthosporium Victoriae* filtrates contain a toxic metabolite depressive for both root development and top growth of oat; the effect is, however, more pronounced on the susceptible "Vicland" than on the resistant "Clinton" variety.

Another phase of host-parasite relationship, which will be also included in the present paper, is the penetration phase compared in the susceptible "Giza 26" and in the relatively resistant "Karnak" cotton seedlings. The mode of penetration, by which *Fusarium* can achieve infection of cotton roots, was a matter of great dispute. Atkinson (1892) suggested that the injury of the underground parts of the cotton plant might provide a way for the wilt fungus to enter the host. Fahmy (1930), in his studies on the mode of *Fusarium* penetration into cotton, stated that the fungus formed a sort of ectotrophic mycorrhiza; its activity was not only restricted to invasion of root cap, but it extended also to involve other root tissues. Yablocova (1937) stated that *Fusarium buharium* penetrated, through unwounded cortex of both susceptible and immune two-days old cotton seedlings, at the collar region.

EFFECT OF FUSARIUM METABOLITES

(i) *Experimental technique* :

Fusarium filtrate was obtained by growing the fungus on autoclaved Richard's solution, at 30°C, for four weeks. The fungal mycelium was subsequently removed by filtration, and the resulting filtrate was divided into two lots : one lot was cold-sterilized by Menon's technique (Menon 1934) and the other was autoclaved. The above filtrate treatments aim at the elucidation of the possible effect of heat on the relative activities of *Fusarium* metabolites and their bearing in influenceing. the seedling vigours of the two experimental cotton varieties.

Pots, each containing 1000 grams of clay soil, were sterilized and kept — under aseptic conditions—at a constant water content. The experimental seeds were firstly surface - sterilized and subsequently transferred into a sterilized moistened saw-dust to ascertain

their germinative potentialities; surface sterilization was achieved by dipping the seeds — for twenty minutes — in concentrated sulphuric acid and then washed for several times in series of sterilized water. After three days, only germinated seeds were transferred into the sterilized soil-containing pots. For every particular treatment, six pots were made; each pot was planted with five surface-sterilized germinating seeds. The following treatments were made for either "Giza 26" or "Karnak" cotton raised seedlings :

(*a*) Watering with autoclaved *Fusarium* metabolites.

(*b*) Watering with cold-sterilized *Fusarium* metabolites.

(*c*) Watering with original unconsumed Richard's solution.

(*d*) Watering with sterilized tap water.

The two last treatments were made to serve as controls; watering was achieved by 100 mls. of the experimental medium and started two days after seeds transference. The pots were subsequently kept at a constant water content by the addition of sterilized water every two days. The raised seedlings were kept — at a temperature range varying from 25°C to 30°C — in a laboratory receiving direct sunlight. After two weeks, the raised seedlings were cautiously removed from the soil, washed thoroughly under running tap water and surface-dried.

(ii) *Experimental results* (*Tables I and II*)

The following criteria have been determined as an expression of the cotton-seedling vigour :

(*a*) Number of lateral roots developed on main tap root.

(*b*) Root length of main tap root.

(*c*) Top height.

(*d*) Fresh weights of roots, tops and whole seedlings.

For every treatment, average determinations of thirty seedlings were calculated and statistical analysis of the results have been made.

The number of lateral roots — given by the main root — is found to decrease in "Giza 26" seedlings raised on *Fusarium* filtrates than in those raised on original solution or tap water; such decrease is more significant on autoclaved than on cold - sterilized metabolites (Table I). On the other hand, "Karnak" seedlings respond differently as manifested by a high significant increase in the number

(Table I)

Vigour responses, expressed as number of lateral roots as well as root length and top height (in cms.), of either "Giza 26" (G) or "Karnak" (K) seedlings, to either autoclaved (A) or cold-sterilized (M) *Fusarium* metabolites; control seedlings are raised on either pure Richard's solution (P.R) or sterilized tap water (T.W)

Vigour criterion	Cotton variety	Experimental medium			
		Fusarium filtrate		(P.R)	(T.W)
		(A)	(M)		
Number of lateral roots	(G)	6±0.5	8±0.8	10±1.3	14±1.3
	(K)	14±1.5	19±1.7	8±0.9	8±0.86
Root length	(G)	7.6±0.5	8±0.3	12±0.6	12.7±0.5
	(K)	9.5±0.4	10.2±0.4	11±0.5	11.4±0.4
Top height	(G)	13.3 ± 0.3	13.8±0.3	16±0.3	16.4±0.5
	(K)	14.5±0.4	15.3±0.3	15.5±0.4	16.1±0.4

of lateral roots in seedlings raised on soil containing *Fusarium* filtrates than on those containing either unconsumed solution or tap water; the highest number is recorded in seedlings responded to cold-sterilized metabolites. The relative decrease in the number of lateral roots — on autoclaving the fungal filtrate — may be due

to the effect of heat in causing a partial deactivation of such root-inducing metabolites.

This tendency of *Fusarium* metabolites under certain nutritive conditions, towards suppressing the number of lateral roots in "Giza 26" and increasing their number in "Karnak" seedlings, might anticipate in creating a disturbance in the host-parasite relationship by decreasing the vigour of the susceptible and increasing that of the resistant cotton variety so far as the number of lateral roots is concerned. Such opposing seedling responses to *Fusarium* metabolites, in the two experimental cotton varieties, express themselves by the highly significant results obtained in comparing the number of lateral roots of "Giza 26" and of "Karnak" treated raised cotton seedlings. Thus, the number of laterial roots in "Karnak" seedlings — raised on soil containing either water or original solution — is always lower than in "Giza 26" seedlings of a similar age and treatment. The balance becomes, however, completely reversed in response to *Fusarium* metabolites; the number of lateral roots becomes significantly higher in "Karnak" than in "Giza 26" seedlings on soil previously treated with differently-sterlized fungal filtrates.

Concerning seedling root length, as a criterion of cotton vigour - response to *Fusarium* metabolites, statistically significant differences were obtained in relation to different treatments of fungal filtrates and control media. Seedlings, of both cotton varieties, showed the highest lengths of their main roots in soil containing either tap water or pure synthetic solution. The root lengths decreased, however in response to differently-traeted *Fusarium* filtrates; the difference is found to be more pronounced in "Giza 26" than in "Karnak" raised seedlings. The same sequence of events was obtained with regard to the top heights of cotton seedlings when watered with experimental media on one hand and with differently-treated *Fusarium* metabolites on the other hand.

(Table II)

Vigour responses (expressed as fresh weights "in grams" of tops, roots or whole seedlings), of either "Giza 26" (G) or "Karnak" (K) cotton variety, to autoclaved (A) and to cold-sterilized (M) *Fusarium* metabolites; control seedling are raised on either pure Richard's solution (P.R) or sterilized tap water(T.W)

Fresh weight of:	Cotton variety	Experimental medium			
		Fusarium filtrate		(P.R)	(T.W)
		(A)	(M)		
Tops	(G)	1.683±0.1	1.537±0.031	1.723±0.014	1.798±0.011
	(K)	1.363±0.025	1.440±0.029	1.303±0.017	1.350±0.020
Roots	(G)	0.1±0.011	0.11 ±0.007	0.123±0.004	0.13 ±0.003
	(K)	).083±0.002	0.097±0.004	0.068±0.002	0.077+0.002
Whole seedlings	(G)	1.7±0.12	1.63 ±0.087	1.83 ±0.029	1.917±0.012
	(K)	1.447±0.015	1.53 ±0.024	1.37 ±0.013	1.423±0.015

Concerning seedling fresh-weights of both cotton varieties (Table II), the only statistically-significant differences were obtained in comparing the top fresh weights of "Giza 26" and "Karnak" seedlings in response to different treatments. On the whole, "Giza 26" seedlings - top fresh weights are always higher than those of "Karnak" throughout; the difference is, however, highest in seedlings receiving water and lowest in those responding to cold-sterilized *Fusarium* metabolites. On the other hand, fresh weight determinations of either roots or whole seedlings have shown non-significant differences on varying the following factors : treatment, cotton variety or both factors.

PENETRATION PHASE

This deals with the cotton varietal differences as a factor in enabling or suppressing *Fusarium* penetration abilities. The two following problems have been elucidated with regard to the penetration phase :

(*a*) The mode of penetration, whether purely mechanical or due to wounds resulting from root rupture during its elongation through soil.

(*b*) The fungal invasion in relation to different root zones and to varying stages of seedling maturation.

A preliminary experiment has been firstly carried out to test mechanical potentiality of *Fusarium* for penetratoin by the paraffin-wax test method.

(i) *Mechanical potentiality of Fusarium conidia for penetration.*

The method used was a modification of that adopted by Brown & Harvey (1927). Paraffin wax was melted in a test tube, which was then rapidly cooled to avoid its crystallization. The resulting wax cylinder was subsequently cut — by a hand microtome — into thin sections, each is 0.5 mm. in thickness; the paraffin discs were left floating over hot water to ensure their homogeneity, flatness and non-porosity. They were then transferred into cold water, for cooling, and gently dried. In order to ascertain the non-porousness of the experimental paraffin discs, the latter were cautiously floated over N/10 NaoH solution and a drop of phenolphthalein was inserted into the surface of the dics; porous discs were soon turned pink and immediately rejected. The discs, which proved to be comlpetely non-porous, were surface-sterlized with alcohol, dried and left to float over sterilized water. Each disc was then inoculated with one drop of aqueous *Fusarium* conidial suspension and incubated at 30°C. Some inoculated discs were examined — for their porosity — after 24 hours, others after 48 hours incubation; non-inoculated control discs were also made for comparison.

The germinative capacities of *Fusarium* conidia — after each incubation period — were tested microscopically, and their effect in inducing porosity of discs was proved by phenolphthalein as prev→ isously described. This test experiment has demonstrated that the hyphal tips of germinating *Fusarium* conidia — after 48 hours incubation at 30°C — could affect mechanical penetration through the experimental paraffin discs.

(ii) *Host penetration*

For testing the mode of fungal penetration into the root tissues of either "Giza 26" or "Karnak" cotton variety, seedlings were raised on Knopf's synthetic solution or on pure clay soil inoculated with *Fusarium* conidial suspensions; control seedlings were also raised in non-inoculated nutritive solution or soil to serve as controls. The raising of cotton seedlings on an inoculated synthetic solution aims at a study of fungal penetration without the intervention of the factor due to mechnical injury of roots by soil particles, which might result in wounds facilitating fungal invasion. A heavy conidial-suspension, from one-week old *Fusarium* culture, was prepared in Knopf's solution. Surface-sterilized cotton seeds, which had been kept for 24 hours at 30°C in sterilized moistened saw dust to initiate germination, were floated over the inoculated Knopf's solution contained in one-litre jars using traps coated with wax to hold up the germinated seeds. All jars were cotton-plugged to avoid, as far as possible, external fungal contaminants.

The raised seedlings, from each one of the two experimental cotton varieties, were susequently removed after the following varying periods of germination : 3, 6, 10 and 14 days. The roots were then cut and divided into three portions according to the sequence of the following zones : root cap, root hairs and collar. The root cut portions were immediately fixed and embedded in paraffin in the usual way; microtome sections were made and double-stained with orange G and thionin (Stoughton 1930 and La Cour 1931).

Fusarium conidia could be traced germinating, on both sterilized synthetic culture and clay soil, after the first two days following seed germination. Chlamydospores, on the other hand, were seen starting germination — in the culture medium — after three days incubation.

Fungal penetration (Fig. 1) was found to take place actually, through roots of both "Giza 26" and "Karnak" cotton varieties, after three-days germination of their respective seeds. In culture medium, the fungal hyphae were never observed penetrating through the zone of root cap. In clay soil, however, penetration occurred along the entire root length starting from ruptured root cap up to the collar zone. In both synthetic culture and clay soil, the most susceptible zone — for fungal penetration — was that of the root hairs. Chlamydospores, either germinating or still in course of germination, were found gathered in the spaces between root hairs; their germ tubes were seen sometimes penetrating into the root hairs themselves. At higher levels, and near the collar zone, fungal penetration was also seen, but it was rare in comparison with that at the zone of root hairs. Penetration of outer tangential walls of piliferous layer, as as well as through junctions between adjacent piliferous cells, could be also observed.

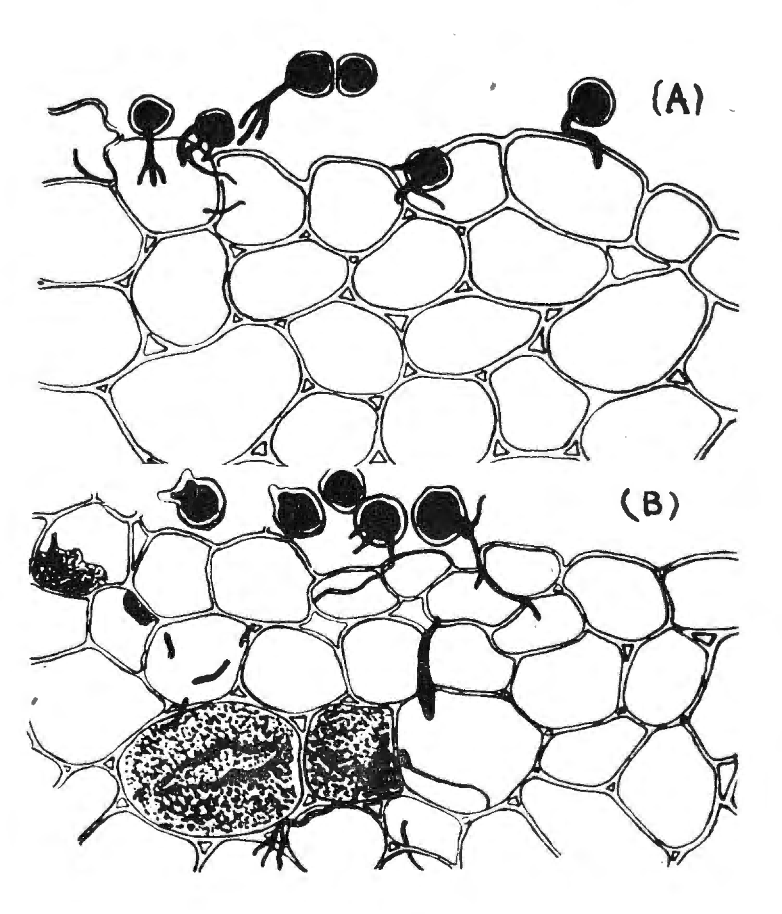


Fig. 1

Mode of penetration of *Fusarium* chlamydospores into "Giza 26" (A) and "Karnak" (B) roots of two - weeks old cotton seedlings (X 720).

DISCUSSION

The present work aims at the elucidation of the physiological significance of resistance and susceptibility — to *Fusarium* wilt — of two Egyptian cotton varieties, namely the susceptible "Giza 26" and the relatively resistant "Karnak" cotton varieties, so far the two following aspects are concerned :

(*a*) The effect of rhizospheric *Fusarium* metabolites on the resulting seedlings-vigour of each cotton variety.

(*b*) Modes of *Fusarium* penetration compared in the two experimental cotton varieties.

The seedling vigours, in response to rhizospheric *Fusarium* metabolites, are found to differ — in certain aspects — according to the experimental cotton variety. Fungal metabolites cause depressions of top heights and root lengths of raised seedlings of the two cotton varieties; the depressions are, however, less pronounced in the relatively resistant "Karnak" than in the susceptible "Giza 26" cotton variety. Similar results have been obtained (Litzenberger 1940) with regard to the nature of resistance and susceptibility of two oat varieties to *Helminthosporium victoriae*. The most prominent difference in host vigour, compared in relation to "Karnak" on one hand and to "Giza 26" on the other hand, is in the response — due to *Fusarium* metabolites — for root initiation and development; the number of lateral roots — produced on the main root — increases in case of "Karnak" and decreases in "Giza 26" cotton seedlings in comparison with those of the controls. The possible presence of a growth - promoting fungal metabolites, stimulating for adventitions - root formation of "Karnak" seedlings, has been further emphasized as will be seen in a subsequent paper dealing with cut - shoot experiments.

Concerning mode of fungal penetration, preliminary tests have demonstrated the mechanical potentiality of *Fusarium* conidial germ tubes to penetrate through paraffin discs. In a similar manner, they could penetrate through unwounded piliferous cells of seedling roots of either one of the two cotton varieties. Penetration takes place mainly in the zone of root hairs; it could be also achieved along

other zones of main root, but root cap could not be penetrated unless it had been ruptured. The fate of the invading mycelium as well as the fungal enzymic potentialities within root tissues, as influenced by the nature of the experimental cotton variety, will constitute the subject matter of the following paper.

SUMMARY

1. The host-parasite relationship during the pre-penetration phase, due to fungal metabolites in cotton-seedling rhizospheric zone, has been evaluated.

2. Relative seedling growth-vigours of the two cotton varieties, as influenced by *Fusarium* metabolites, have given the following results :

(*a*) Number of lateral roots decreases in "Giza 26" seedlings and increases in those of "Karnak".

(*b*) Root lengths decrease, in seedlings of both cotton varieties, in response to different treatments of *Fusarium* metabolites, the decrease is, however, more significant in the susceptible "Giza 26" than in the resistant "Karnak" cotton seedlings. The same sequence of results occurs with regard to top heights.

(*c*) Top fresh weights are also significantly affected. On the other hand, fresh weight determinations of roots or whole seedlings show non-significant results.

3. The host-parasite relationship, during the penetration phase, was also elucidated in relation to the two experimental cotton varieties.

4. The mechanical potentialities of *Fusarium* conidia to penetrate have been demonstrated by paraffin-wax test method as well as by anatomical studies on both cotton varieties.

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(i)

ANALYSIS OF VARIANCE OF RESULTS SHOWN IN (TABLE 1)

Number of lateral roots :

Item	Number of degrees of freedom	Variance ratio	Remarks
Treatment (T)	3	54.7	Highly significant
Variety (V)	1	77.7	Not significant
(T X V)	3	191.3	Highly significant

ERROR 232

TOTAL VALUES OF TREATMENT ON BOTH COTTON VARIETIES

Cotton Variety	(A)	(M)	(P.R.)	(T.W.)
"Giza 26"	184	264	314	420
"Karnak"	408	577	251	242
	592	841	565	662

Significant difference for (T) and (TXV) = 6.009

Root length :

Item	Number of degrees of freedom	Variance ratio	Remarks
(T)	3	86.99	Highly significant
(V)	1	6.57	Not significant
(TXV)	3	23.92	Not significant

ERROR 232

TOTAL VALUES OF TREATMENT ON BOTH COTTON VARIETIES

Cotton variety	(A)	(M)	(P.R.)	(T.W.)
"Giza 26"	227	240.5	358.5	380
"Karnak"	283.5	306.5	330	343
	510.5	547	688.5	723

Significant difference for (T) = 3.988

Top height

Item	Number of degrees of freedom	Variance ratio	Remarks
(T)	3	247.1	Highly significant
(V)	1	47.96	Not significant
(TXV)	3	53.18	Not significant

ERROR 232

TOTAL VALUES OF TREATMENT ON BOTH COTTON VARIETIES

Cotton variety	(A)	(M)	(P.R.)	(T.W.)
"Giza 26"	397.5	414	480	490.5
"Karnak"	434	458	463.5	484
	831.5	872	943.5	974.5

Significant difference for (T) = 1.48.

(iii)

ERROR 16

ANALYSIS OF VARIANCE OF RESULTS SHOWN IN (TABLE II)

Fresh weight of "Tops"

Item	Number of degrees of freedom	Variance ratio	Remarks
(T)	3	15.4	Not significant
(V)	1	568.2	Not significant
(TXV)	3	35.9	Highly significant

TOTAL VALUES OF TREATMENT ON BOTH COTTON VARIETIES

Cotton variety	(A)	(M)	(P.R.)	(T.W.)
"Giza 26"	48.4	46.1	51.7	53.95
"Karnak"	40.9	43.2	391.	40.5

Significant difference for (TXV) = 0.866.

Fresh weight of "Roots" :

Item	Number of degrees of freedom	Variance ratio	Remarks
(T)	3	3.077	Not significant
(V)	1	110.3	Not significant
(TXV)	3	11.9	Not significant

ERROR 16

TOTAL VALUES OF TREATMENT ON BOTH COTTON VARIETIES

Cotton variety	(A)	(M)	(P.R.)	(T.W.)
"Giza 26"	3	3.3	3.7	3.9
"Karnak"	2.5	2.9	2.05	2.3

Fresh weight of "Whole seedlings" :

Item	Number of degrees of freedom	Variance ratio	Remarks
(T)	3	3.73	Not significant
(V)	1	203.9	Not significant
(TXV)	3	16.3	Not significant

ERROR 16

TOTAL VALUES OF TREATMENT ON BOTH COTTON VARIETIES

Cotton variety	(A)	(M)	(P.R.)	(T.W.)
"Giza 26" 51		48.9	54.9	57.5
"Karnak" 43		45.9	41.1	42.7

* * *

NOTE SUR QUELQUES MONNAIES ET JETONS FATIMITES DE SICILE

par

PAUL BALOG.

Au cours d'un bref séjour en Sicile, pendant le mois de Juillet 1955, nous avons eu l'occasion d'examiner des monnaies fatimites et quelques jetons en verre, appartenant au Musée National de Siracusa, à la Bibliothèque Communale de Palermo et au Musée de Gela.

Nous adressons nos remerciements les meilleurs à Mlle. le Dr. M. E. Alaimo, Directeur de la Bibliothèque Communale de Palermo, qui a mis à notre disposition les collections numismatiques et a personellement assisté à nos recherches.

Nous sommes aussi très reconnaissants au Dr. G. V. Gentili, Inspecteur à la Surintendance des Antiquités de Siracusa, qui nous a facilité l'examen des monnaies fatimites et des jetons en verre conservés au Musée National de Siracusa.

Le Dr. Orlandini, très aimablement, nous a montré un jeton de Hâkim conservé au Musée de Gela.

MONNAIES D'ARGENT
(ET UNE MONNAIE D'OR)

Les monnaies d'argent fatimites, aussi bien dans les collections de Sicile que dans celles d'autres pays, sont plus rares que les pièces en or. Ce n'est pas de dire que l'argent était nécessairement moins abondant sous les Fatimites que l'or, mais il a moins bien résisté aux vicissitudes du temps.

Le *Musée National de Siracusa* possède vingt six monnaies d'argent minuscules appartenant aux règnes des khalifes Al 'Aziz et Al Hâkim. Ces pièccettes ont 9 à 10 mm. de diamètre et pèsent environ 0 grm. 20 chaque. Elles sont, à une exception près, inédites.

AL ᶜAZIZ-BILLAH (365-386 H.)

1. Aux deux cotés : cercle de grénetis puis cercle linéaire périphériques.

Droit :	الامام العزيز بالله	Revers :	نزار أمير المؤ منين

1 exemplaire.

2. Aux deux cotés : cercle de grénetis puis cercle linéaire périphériques.

Droit : الامام العزيز بالله

Revers : عزيز بالله أمير المؤمنين

Puis un point central entouré d'un petit cercle linéaire, sur les deux cotés.

1 exemplaire.

AL HAKIM BIAMR-ILLAH (386-411H.)

Les vingt quatre pièces du *Musée de Siracusa* se divisent en quatre variétés et un certain nombre dont le coté droit est illisible forme un cinquième groupe non déterminé. Les légendes, toutes sur trois lignes horizontales, sont entourées d'un cercle linéaire et d'un cercle de grénetis extérieur. Seule l'inscription du droit varie, celle du revers est toujours la même.

1.	Droit :	الامام المنصور أبو على	Revers :	الحاكم بأمر الله أمير المؤمنين

Cette variété a été déjà décrite (Lagumina : Catalogo, Nos 49-51 et Br. M. Cat. IV No. 103). Les autres sont à notre connaissance inédites.

2.	Droit :	الحاكم أبو على أمير المؤمنين	Revers :	الحاكم بأمر الله أمير المؤمنين

	Droit :	Revers :
3.	الامام أبو على الحاكم أمير المؤمنين	الحاكم بأمر الله أمير المؤمنين
4.	الحاكم بأمر الله أمير المؤمنين	idem.
5	illisible	idem

La *Bibliothèque Communale de Palermo* possède une cinquantaine de ces kharroubas d'argent de Hâkim, à part celles déjà cataloguées par Lagumina. Elles appartiennent toutes, aux catégories que nous venons de décrire.

AL MUSTANSIR-BILLAH (427-487 H.)

Le *Musée de Siracusa* possède aussi six petits dirhems étoilés, pareils aux monnaies décrites par nous (Bull. Institut d'Egypte T. XXXVI 1953 p. 334-336). Cinq pièces proviennent de la trouvaille de Modica en 1948, No. 48, 225/230, la sixième porte le No. 47, 734. Ces dirhems pèsent tous environ un gramme chaque.

Les dirhems étoilés sont fort rares; de plus les exemplaires du Musée de Siracusa présentent un intéret spécial à cause des globules situés dans les espaces formées par l'étoile dans le petit cercle. Les six pièces se classent par le nombre et la localisation de ces globules, en cinq variétés distinctes, représentant probablement une indication de l'année d'émission. Les dirhems de Siracusa ont tous le bord rogné ; mon temps ayant été très limité je n'ai pas pu établir s'il y avait moyen de reconstruire la légende périphérique suffisamment pour fixer la date. Mais Lavoix a déjà amorcé la solution par sa note au bas de la page 121 du Vol. III de son Catalogue des Monnaies Musulmanes de la Bibliothèque Nationale. N'ayant connu que les Rouba' d'or, il ne pouvait parler de dirhems. Mais il s'agit d'émissions analogues du même faciès; il est par conséquant à supposer que le système d'indication par points spécialement disposés était identique pour les différents métaux. Voici l'observation de Lavoix : "Les Rouba' siciliens au type de l'hexagone se divisent en trois groupes.

Le premier, de l'an 442 à l'an 446, présente dans le cercle intérieur un point accosté de deux points. Le second apparait en 446; il n'offre qu'un seul point au centre; le dernier, de l'an 446 à l'an 448, porte six points autour du point central de l'hexagone." Il faut espérer la trouvaille d'exemplaires nouveaux de dirhems avec la date conservée afin que l'exacte valeur des globules puisse être déterminée. Vu le nombre des variétés on pourrait supposer qu'elles représenteraient des années distinctes et non pas des groupes d'années comme sur les Rouba'.

Voici le tableau schématique des cinq variétés de dirhems, avec indication des globules mais sans les légendes :

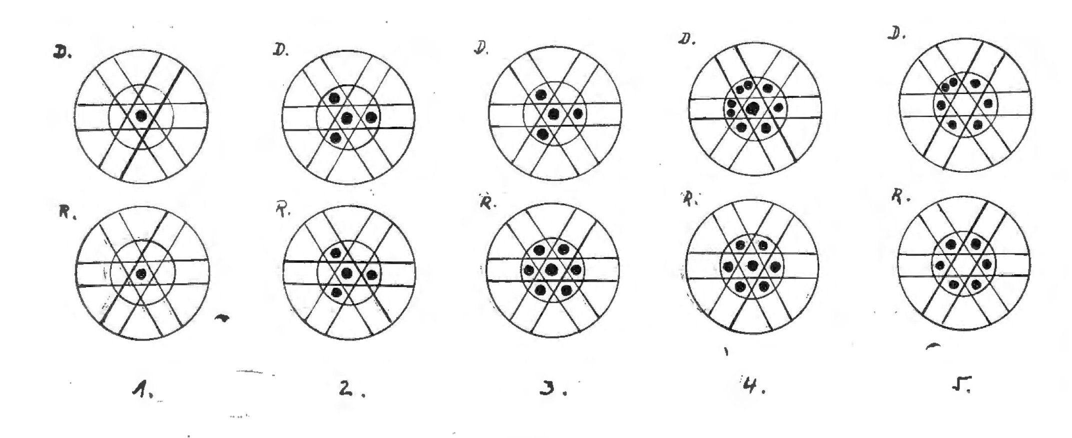


Fig. 1

Un quart de dinar en or du khalife Al Mustansir-billah, sortant de l'ordinaire, doit être encore mentionné parmi les collections du *Musée de Siracusa* : nous en avions publié un exemplaire plus complet (Bull. Institut d'Egypte T. XXXVI (1953) p. 328). Ce Rouba' présente sur les deux cotés, deux légendes circulaires et une courte légende centrale, toutes séparées les unes des autres par des bandeaux lisses et bornées de cercles linéaires. Sur l'exemplaire du *Musée de Siracusa* la légende marginale est presque totalement hors du flan ; seules les bases des caractères sont présentes mais, en comparant ce qui reste de la légende avec la lecture de mon exemplaire, on pourrait arriver à la déchiffrer. Sans doute, cette pièce a été elle aussi, frappée en Sicile, l'an 434 H.

Droit : Légende circ. ext. : hors du flan

Légende circ. int. : أبو تميم المستنصر بالله أمير المؤمنين

Centre : معد

Revers : Légende circ. ext. : hors du flan

Légende circ. int. : لا اله الا الله محمد رسول الله علي ولى الله

Centre : الامام

Un exemplaire incomplet (le lieu de frappe manque) se trouve au Cabinet des Médailles à Paris, sous le No. 392, Lavoix III.

La collection des monnaies de la *Bibliothèque Communale de Palermo* contient vingt quatre monnaies d'argent minuscules de Mustansir non cataloguées et inédites, qui semblent provenir toutes de la même trouvaille. Ces pièces minces comme une feuille de papier pèsent environ 0 gram. 20 chaque et ont un diamètre de 4 à 5 mms. Sur les deux faces, elles présentent une légende écrite sur deux lignes horizontales entourée d'un cercle linéaire, puis d'un cercle de grénetis.

Droit :	Revers :
الامام	الله
معد	الصمد

Fig. 2

Cette monnaie est d'un intéret spécial non seulement par ce qu'elle est inédite, mais plus encore car elle nous apprend le motto du souverain : Allah al samad. Nous rappelons à ce propos que nous avons pu identifier les mottoes de plusieurs khalifes fatimites de leurs monnaies d'argent ainsi que de leurs rares monnaies de cuivre ; celui de Mustansir n'avait pas été rencontré jusqu'à présent, il vient donc s'ajouter à la série déjà publiée (Bull. Institut d'Egypte T. XXXIII (1956) p. 18). Les mottoes des khalifes fatimites depuis Hâkim jusqu'à el 'Adid sont ainsi connus, à l'exception de Zâfir et

Fâiz. Les voici :

Hâkim	حسبي الله	jetons en verre
Mustansir	الله الصمد	dirhems
Must'aly	الله الصمد	dirhems
Amir	الله المشكور	fels
Muntazar	الله الصمد	dirhems
Hâfiz	الله الحميد	dirhems
Zâfir	inconnu	—
Fâiz	inconnu	—
'Adid	يعتضد بالله	dirhems

Il paraîtrait que le motto الله الصمد ait joui d'une certaine préférence car il apparaît sur les monnaies de Mustansir, Must'aly et de l'usurpateur Muntazar.

JETONS EN VERRE

Les jetons en verre arabes sont peu nombreux dans les collections siciliennes accessibles aux recherches. La plupart sont d'origine incertaine mais il existe des exemplaires provenant de fouilles officielles. Ces pièces de provenance certaine prouvent que les jetons fatimites ont bien existé en Sicile à l'époque de leur circulation.

A part quelques poids monétaires 'abbassides et un certain nombre de jetons post-fatimites — sans doute importés par des collectionneurs modernes — toutes les pièces sont des jetons fatimites. La domination arabe ayant définitivement pris fin avec la chute de Palermo en 464 H. les quelques jetons d'Amir et de Hâfiz qui se trouvent dans ces collections ont du être eux aussi importés en temps modernes comme les jetons encore plus tardifs.

Le jetons fatimites se trouvant dans les collections siciliennes semblent avoir été fabriqués en Egypte et importés dans l'Ile pour y circuler. Ils appartiennent tous à des faciès déjà connus d'Egypte.

La collection la plus importante de jetons en verre se trouve au *Musée National de Siracusa*. Il se compose d'une cinquantaine de pièces dont :

1	mithkal anonyme umayyade ou 'abbasside	
2	jetons de 'Aziz	
19	„	de Hâkim
1	„	de Zâhir
1	„	de Mustansir
2	„	de Amir
2	„	anonymes avec : عادل , probablement d'Aziz
et 2	„	avec : عبد الله بأمر الله (Fig. 3)



Fig. 3

Bien qu'anonymes, ces deux derniers jetons présentent un protocole qui se rapproche à celui de Hâkim, à qui ils pourraient appartenir (الحا كم بأمر الله). Les autres pièces sont toutes postfatimites.

Un jeton de Hâkim trouvé dans les fouilles de Sofiana — l'ancienne Philosophiana — dans la province de Gela, se trouve actuellement au *Musée de Gela* (Dr. Orlandini). (Fig. 4)

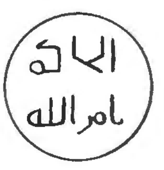


Fig. 4

Blanc translucide, dévitrifié.

C'est un des rares documents qui prouvent incontestablement que les jetons en verre ont été employés en Sicile fatimite.

La *Bibliothèque Communale de Palermo* possède huit jetons en verre de Hâkim, un d'Aziz et un de Mustansir, ainsi que plusieurs jetons tardifs probablement acquis durant les derniers cent ans. Il

faut signaler encore un jeton de cette collection, au faciès fatimite mais anonyme et à notre connaissance inédit :

Légende circulaire entre deux cercles pointillés :

العز اليمن السعد السلام له

Centre :

الامام
عبد الله
أمير



Uniface. Verre mauve peu translucide, traversé par un ruban diagonal blanc laiteux.

Fig. 5

Il est interessant à noter que d'un total de quarante et un jetons fatimites examinés, vingt huit sont de Hâkim et treize pièces seulement appartiennent à tous les autres khalifes ou sont anonymes.

Les richesses économiques de la Sicile musulmane tant vantées par les historiens arabes ne trouvent pas leur confirmation dans les documents numismatiques. Tandis que le dinar de quatre grammes et fractions a été l'unité normale de la monnaie d'or en Egypte, en Afrique du Nord et en Syrie, nous n'en connaissons pas d'exemplaire frappé en Sicile. En effet, toutes les pièces d'or fatimites siciliennes connues sont des quart de dinar du poids d'un gramme environ. On serait donc amené à conclure que l'économie de la Sicile, beaucoup moins riche que celle de la métropole devait se contenter du quart de dinar comme unité monétaire. Tout compte fait la Sicile n'était qu'une province secondaire.

Les monnaies d'argent semblent d'ailleurs confirmer cette impression; à part quelques dirhems étoilés de Mustansir, qui pèsent environ un gramme, toutes les autres pièces d'argent sont minuscules et ne dépassent pas le kharrouba de 0 gramme 20.

Les quelques observations qui précèdent ont été relevées au cours d'une visite, hélas, trop rapide de la Sicile. Nous nous souhaitons de pouvoir étudier les richesses numismatiques arabes de cette Ile dans l'avenir de façon plus approfondie, comme il se devait.

The Temperature Coefficient of the Chromium and Molybdenum Electrodes and its Bearing on the Passivity of these Metals (1)

By

A. Riad Tourky, I. M. Issa and H. Khalifa.

SUMMARY

The temperature coefficients of the molybdenum and chromium electrodes as measured in solutions initially free from the metal ions are found to be high and variable.

It is found that the molybdenum and chromium electrodes in analogy to electrodes of other higher-valent metals are always superimposed by an oxygen overvoltage effect to which may be attributed the passivity of these metals. The passivity is apparently more pronounced in case of chromium than in molybdenum, as the area of the electrode covered by oxygen amounts to 2/3 in the former and to 1/4 in the latter. The E'_o-temperature diagrams in both cases are characterised by minima and maxima within the temperature range 15-50°C. As revealed from thermo-chemical calculation, the oxide of molybdenum stable in contact with the metal is the pentoxide.

As was previously shown antimony and arsenic electrodes behave in solutions of varying pH and initially free from the metal ions as metal-metal oxide-oxygen rather than as metal-metal oxide electrodes[1]. The E'_o values manifested by those electrodes were found to be higher than the corresponding thermodynamic values

(1) Communication présentée en seance du 25 Avril 1955.

by about one decivolt due to the presence on their surface of oxygen doublets contributing an overvoltage effect which superimposed the reversible values. This behaviour was explained in the light of the theory of lattice defects[2] by considering that in these oxides such defects are more or less restricted to oxygen rather than to the metal ions which are thus not liable to diffusé towards the metal oxide-solution interface[3]. Oxygen deposited on the electrode surface may accordingly be held to the surface without contributing to its thickening. Further evidence in support of the presence of an oxygen film was obtained from a study of the temperature coefficient of the antimony electrode which was found contrary to the temperature coefficients of stable systems such as the copper-cuprous oxide electrode, to be high and variable[4]. Since many higher-valent metals are known to be permanently passive, the idea suggested itself that the passivity of these metals may be due to the same effect. If this were the case metals such as chromium and molybdenum should manifest the same behaviour. The object of the present investigation is to obtain information regarding this point.

EXPERIMENTAL

The Electrodes

Stick chromium electrodes $1\,{}^1/_2$ cm in length and 7 mm in diameter were prepared by the mechanical shaping of chromium lumps provided by Kahlbaum. Electrical contact was maintained by means of a copper wire soldered to one end of the electrode. The wire passed through a glass tube that was fixed to the electrode with a rubber tubing previously treated with boiling dilute hydrochloric acid.

Stick molybdenum electrodes were prepared from pieces of pure molybdenum wire provided by Johnson - Matthey (England), each 3 cm in length and 2 mm in diameter tightly sealed into glass tubings. Another type of molybdenum electrodes consisted of the metal powder obtained by reducing chemically pure molybdenum trioxide with pure hydrogen at 1000°C. The powder was placed in small glass cups surrounding short tipped platinum wires sealed into glass tubings. In all cases electrical contact was maintained through mercury and copper wires introduced into the tubings.

Procedures

The methods applied for evaluating the temperature coefficient involved:

I — Measurements of the electrode potential of the stick and powdered molybdenum electrodes in unstirred buffer solutions of the Clark-Lubs and the Ringer series in an air thermostat at temperatures varying between 20° and 60°C.

II — Measurements of the potentials of the stick molybdenum or chromium electrodes during the neutralisation of the universal buffer mixture of Britton and Robinson with a carbonate free-sodium hydroxide solution. The titrations were performed in a water thermostat at temperatures ranging from 15 to 55°C. The pH values of the universal buffer mixture at each alkali addition were separately determined at the respective temperatures using the hydrogen electrode. The potentials set were plotted against pH and the E'_o values at each temperature obtained by extrapolating the E_h-pHpl ot to zero pH.

Thermochemical Data

Molybdenum being a polyvalent metal may go into solution as tri-, penta- or hexavalent ions. The predomenance of any of these species may be determined from a relation such as:

$$E_{o1} + 0.059/Z_1 \log [Me^{Z_1}] = E_2 + 0.059/Z_2 \log [Me^{Z_2}] \quad (1)$$

from which the equilibrium constant $K = \frac{\sqrt[Z_1]{Me^{Z_1}}}{\sqrt[Z_2]{Me^{Z_2}}}$ can be calculated. Since none of the E_o values is known with certainty, contrary to the redox potentials of the systems Mo^{+5}/Mo^{+3} and Mo^{+6}/Mo^{+5}, one can apply Luther's equation

$$E_{Me/Me^{Z_2}} = \frac{Z_1 E_{Me}{}^{Z_1} + (Z_2 - Z_1)\, E_{Me^{Z_1}/Me^{Z_2}}}{Z_2} \quad (2)$$

from which it follows that $E_oMo/Mo^{+5} = -0.22$ v. and $E_oMo/Mo^{+6} = -0.095$ v. In these calculations E_oMo/Mo^{+3}, E_oMo^{+5}/Mo^{+3} and E_oMo^{+6}/Mo^{+5} were set equal to –0.2, –0.25 (for the green form stable at lower acidities) and 0.53 volt respectively[5]. Uusing the above relation

$$K_1 = \frac{(Mo^{+5})^{1/5}}{(Mo^{+3})^{1/3}} = 2.188 \text{ and } K_2 = \frac{(Mo^{+6})^{1/6}}{(Mo^{+5})^{1/5}} = 0.0076$$

are obtained. The high values of K_1 compared with K_2 indicates that molybdenum goes almost exclusively into solution as $Mo^{+/3}$ and

Mo^{+5} ions. However Mo^{+3} ion is unstable when compared with Mo^{+5} which possesses a certain stability in presence of atmospheric oxygen[6], hence we may assume that the oxide more stable in contact with the metal is the pentoxide.

Assuming that the latter oxide is formed according to the relation:

$$2\ Mo + 10\ OH^- = Mo_2O_5 + 5\ H_2O + 10\ e$$

hence from a knowledge of the free energy of formation of each of the reactants and resultants, the net free energy change of the reaction and accordingly the reversible potential of the Mo/Mo_2O_5 system can be computed.

The free energy of formation of Mo_2O_5 at 35°C as obtained from the relation $\Delta F = \Delta H - T \Delta S$ is –307000 cals. For calculating the latter value, entropy values at 298.1 for oxygen and elementary molybdenum of 49.013 and 6.83 respectively are used which on integration between 298.1 and 308.1 yield the values 49.13 and 6.89 respectively. Since ΔH and ΔS of Mo_2O_5 are not known, the corresponding values for W_2O_5 i.e. –337900 cals. and 34.87 cals. are used, owing to the great analogy between oxides of both metals[6]. Taking the free energy of water and OH^- ion at 35°C equal to –56143 and –36865 cals. respectively, ΔF for the above reaction amounts to –219065 cals from which the E'_0 value of the Mo/Mo_2O_5 system is –0.112 volt, ($E_0 OH/H_2$) = –0.836 volt at 35°C). Similarly for the Cr/Cr_2O_3 system the E'_0 value can be calculated if the formation of Cr_2O_3 takes place according to the reaction:

$$2\ Cr + 6\ OH^- = Cr_2O_3 + 3\ H_2O + 6\ e \qquad (2)$$

Following the same procedure and applying ΔH and ΔS for Cr_2O_3 equal to –269700 and –65.3 cals respectively, ΔF of the oxide will amount to –24680 cals from which the E'_0 value of the Cr/Cr_2O_3 system is –0.573 volt.

RESULTS AND DISCUSSION

Fig. 1 showing representative E_h-pH plots at 35° C for all types of electrodes used in this investigation is self-explanatory. Strictly linear relationships could not be obtained with chromium electrodes in the unstirred solutions. Extrapolation of the linear portions of the curves leads to E'_0 values as shown in table I in which are also listed the corresponding thermodynamic E'_0 ones.

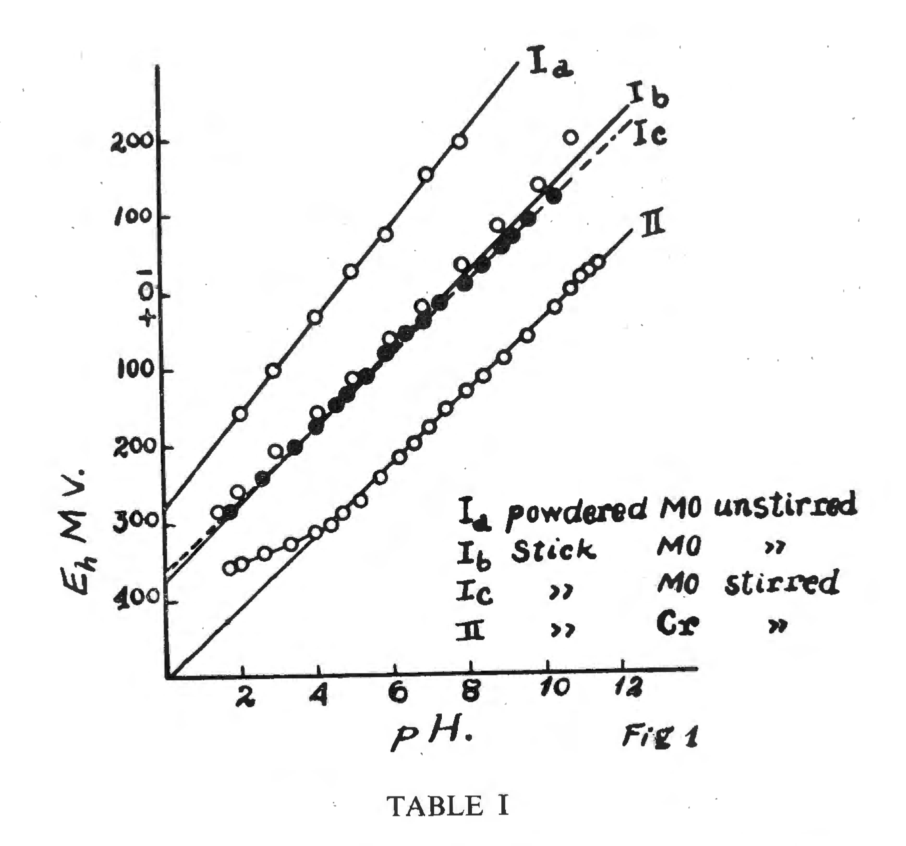


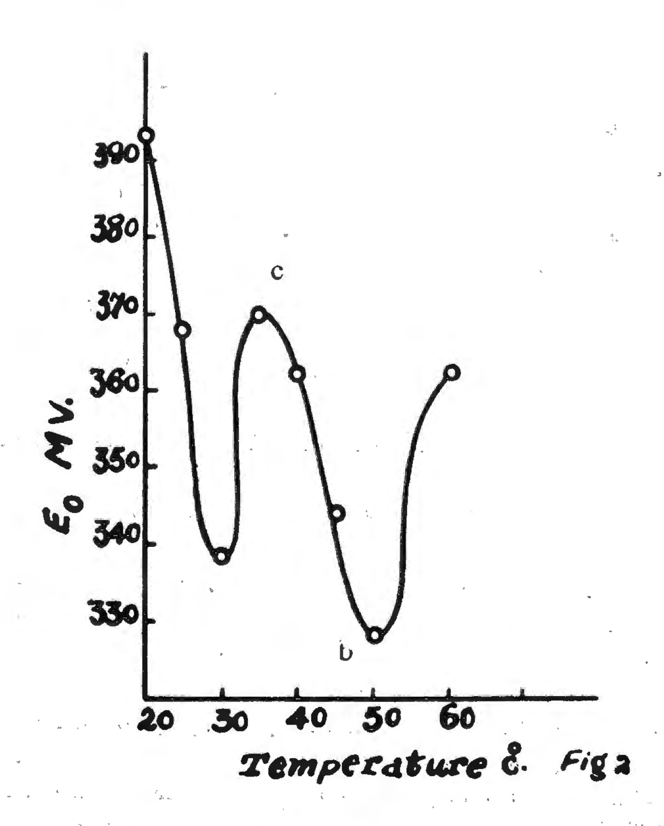
TABLE I

	Exprimental E'_0		Thermodynamic E'_0
	Stirred solution	*Unstirred solution*	
Powdered Mo	—	0.280	–0.112 v.
Massive Mo	0.365	0.370	–0.112 v.
Massive Cr	0.500	—	–0.573 v.

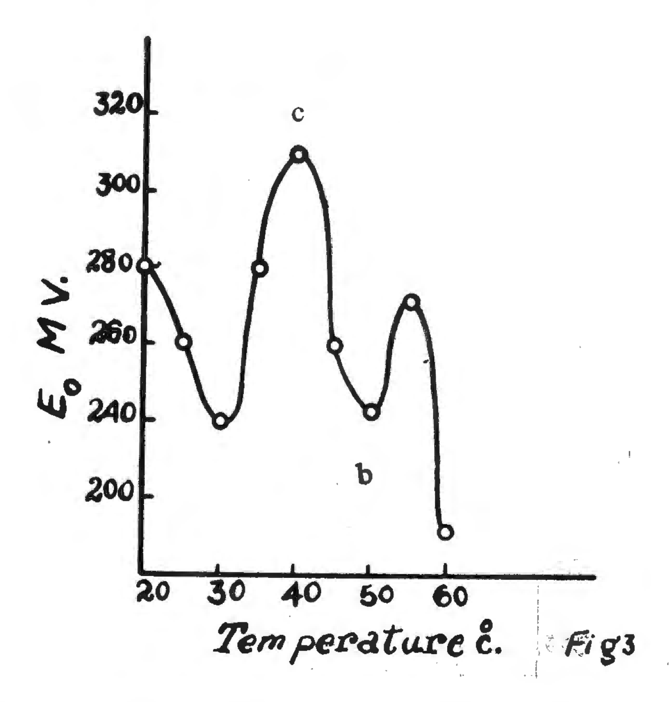
As was shown by Bowden the quantity of electricity necessary to establish oxygen overvoltage per 100 millivolts is 11 x 10^{-7} coulombs which is necessary to cover 1/15 of the surface with oxygen doublets[8]. The overvoltage values observed correspond to $\sim$1/4 and 2/3 of the electrode surface being covered with oxygen doublets in case of molydenum and chromium electrodes respectively as compared with 2/15 for the tellurium electrode[9] ($\sim$200 mv) and $\sim$1/15 for the antimony or arsenic electrode[4]. If the surface area of the

electrode covered with oxygen doublets is taken as a measure of passivity, hence the metals investigated should be placed with respect to their passivity in the following order:

Chromium, molybdenum, tellurium, antimony and arsenic. The considerable passivity manifested by the massive molybdenum and chromium electrodes is substantiated by the fact that stirring has but little effect on the overvoltage superimposing these electrodes and that by involving the powdered metals in the electrodic system, the overvoltage effect is only slightly lowered in comparison with other metals (Te, As and Sb).



By plotting the extrapolated E'_0 values against temperature, E'_0-temperature diagrams as shown in figs 2-5 are obtained. These curves possess almost the same general shape as with the antimony electrode, inasmuch as they possess minima and maxima within the

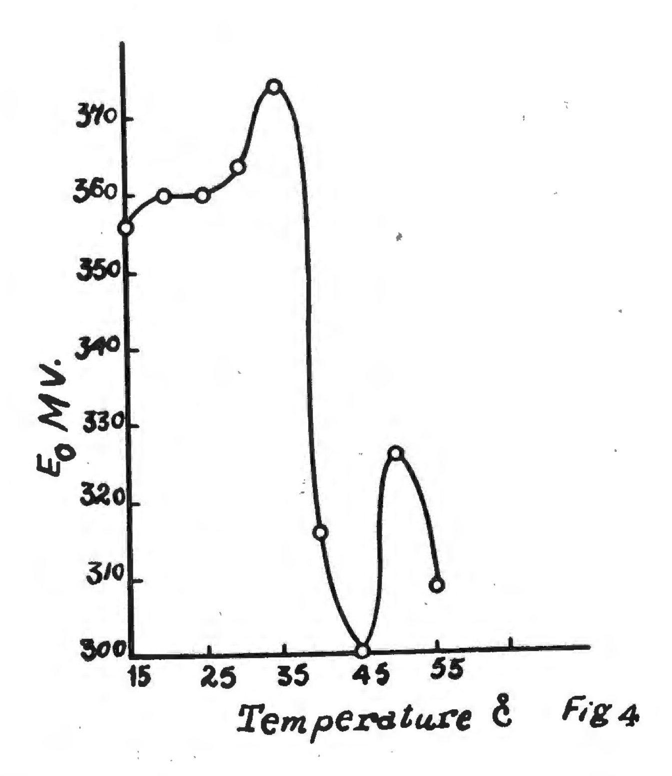


temperature range used. The temperature coefficients for the different parts of these curves are recorded in table II, from which it is apparent that such higher-valent metal electrodes usually possess high and variable temperature coefficients.

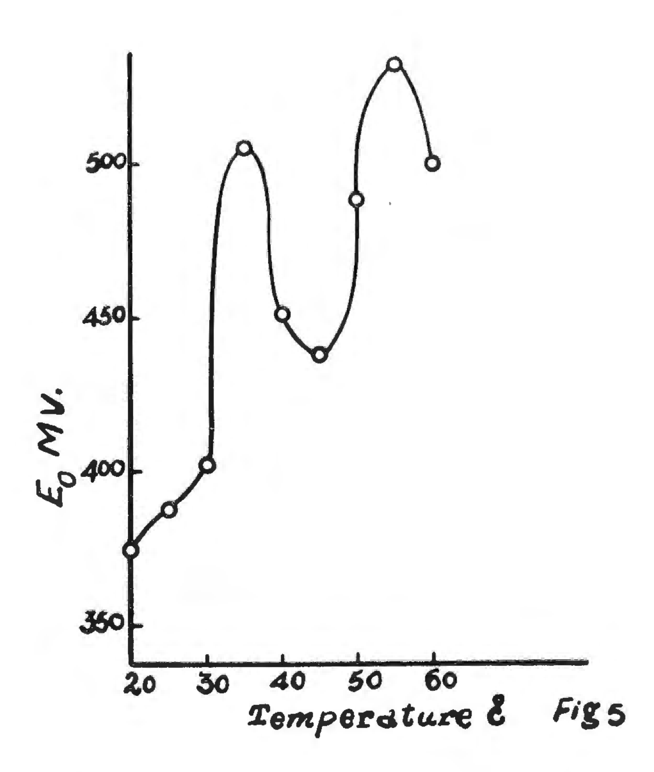
TABLE II

Fig. 2.	Temp. range	20–30	40–50°C	Fig. 3.	20–30	40–50	55–60°C
	$\Delta E_0/\Delta t$,mv/°C	–5.4	–3.4		–4	–6.8	–12
Fig. 4.	Temp. range	35–45	50–55°C	Fig. 5.	35–45		55–60°C
	$\Delta E_0/\Delta t$,mv/°C	–7.4	–3.6		–7		–8

The lowest minima observed are still higher by ~300, 380, 360 and 950 millivolts than the thermodynamic values for the powdered, and the stick molybdenum electrodes in the unstirred solutions and the stick molybdenum and chromium electrodes in the stirred solutions



respectively. In general, rise in temperature and dissolution away of an oxide in a lower-valent state may bring about a depolarising effect with subsequent decrease in the overvoltage, whereas exposure of parts of the metal surface may help in catalysing the discharge of hydroxyl ions and this leads again to the oxidation of the metal and the reestablishment of the overvoltage effect. As with the antimony electrode, the formation of hydrogen peroxide as a result of OH^- ion discharge may play an important role during the process. Thus in the cases under consideration a sudden rise in potential occurs almost between 30° and 40°C (figs. 2 & 3) which lies within the rang of temperatures at which the rate of thermal decomposition of hydrogen peroxide is a maximum i.e. at 35°C in the presence and at 40-50°C in the absence of a catalyst [10]. It is probable that in the region of the first minima the discharge of OH^- ions catalysed by the bare metal portions predominates over the depolarising effect, thus leading to the accumulation of oxygen on the electrode surface and subsequently to the sudden rise in potential. That the oxygen film is held by van der Waal's forces rather than by chemisorption is



borne out by the fact that the activation energy as calculated from the difference in potential between the minimum at b and the maximum at c (42 and 68 mv) amounts only to 3875 and 6270 cal/mole respectively which is of the same order of magnitude as the heats of condensation of gases.

A remarkable feature of the molybdenum electrode is that stirring (fig. 4) does not lead to the observed decrease in potential in the unstirred solutions at 30°C (fig. 2). It is possible that stirring provides the electrode surface with fresh quantities of oxygen to replace any amounts depolarised through rise of temperature or through the dissolution away of an oxide at a lower valency state.

The behaviour of the stick chromium electrode in the stirred solutions (fig. 5) is almost the same as that of the molybdenum electrode under the same conditions, save for the fact that chromium can apparently accomodate more oxygen on its surface and with more tenacity. This manifests itself in:

a) The higher oxygen overvoltage effect superimposing this electrode (960 mv as compared with 417 mv with molybdenum at 25°C).

b) The higher initial rise in potential between 30 and 35°C amounting to 90 mv as compared with 10 mv in case of the molybdenum electrode.

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The Igneous and Metamorphic Rocks of the Aswan Area, Egypt

(WITH A NEW GEOLOGICAL MAP OF THE AREA AND TABLES OF ROCK ANALYSES) (1)

by

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INTRODUCTION AND PREVIOUS LITERATURE

Literature on the Aswan area is immense compared with other parts of Egypt. From the geological point of view, among early writers *De Rozière* (1813, 1826) gave a detailed descriptive account of the different rock varieties he collected in the vicinity of Aswan, basing his description on the colour of the felspar or the amount of dark constituents of the rocks. He also deplored the application by Werner of the term 'syenite' to the rocks of Falsberg, Saxony, in the mistaken belief that they were similar to the coarse grained potash felspar-rich granites of Aswan already given that name by Pliny (Syene is the ancient name of Aswan). De Rozière pointed out that the Falsberg syenite had little or no quartz unlike that of Aswan. The modern term of syenite as concieved by the great German scientist was, however, by then well established and used all over Europe and the Aswan rocks of that name had to acquire other names. In 1867, *Hawkshaw* gave a detailed description of the rocks of the Aswan Cataract (numerous islands obstructing the

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(1) Communication présentée en séance du 10 Janvier 1955

Nile south of Aswan town) but *Dawson* (1884, 1886) was the first to attempt a chronological distinction between the different rock varieties. He recognised two crystalline series below the Nubian Sandstone, the older of which was made up of a complicated association of micaceous and hornblendic schists alternating with gneisses and all of them being penetrated by dykes of granite and diorite. The youuger crystalline formation (observed on the Island of Biga) was also made up of gneiss and schist and overlying the older one but unlike it was not permeated by the granite dykes but by veins of red felsite and basalt-looking rocks. *Bonney* (1886) gave a detailed petrographic description of some of the rock specimens collected by Dawson.

In 1907 *Ball's* important Memoir on this complex area appeared accompanied by a detailed geological map (scale 1:20:000). Ball's views on the history of this complex are as follows (Ball, 1907, pp. 94 - 5) : the oldest rocks are the *schists and gneisses* which were originally of definite igneous origin but were extensively sheared. Into these were intruded *a fine grained granite* to be followed by the intrusion of the *coarse Aswan granite*. Then "the compound mass was crushed by the continual contraction of the crust, converting much of this rock (the coarse granite) into gneiss and still further altering the surrounding masses while dykes and irregular masses of *coarse pegmatite* were forced into cracks in it." Further compression followed producing faults and fissures along which *felsite and porphyrite* dykes were injected and at a still later date more basic dykes and laccolithic masses of *basalt*, *diabase* and *porphyrite* were intruded sometimes with their margins chilled. However, in many places throughout the Memoir (e.g. pp. 68, 77 and 90) Ball pointed out the frequent local variation that occurs between his different rock-types and to the insensible passage of one variety to another and of sheared varieties to unsheared ones.

Barthoux (1922) in his Memoir on the eruptive rocks of the Eastern Desert gave a table indicating the relative ages of these rocks (p. 126). He considered *dioritic* and then *granodioritic intrusions* to be injected into a series of older schists and gneisses and *followed by the Aswan granite*. He recognised an anorthositic variety in the early dioritic intrusions (p. 145) and considered the *fine grained granite* as a border variety of the coarse grained granite (p. 177).

Like Ball, Barthoux also stressed on the fact of the passage of many of his magmatic rock types into another (e.g. pp. 138, 144, 145 and 147) and stated that 'it was impossible to describe all the types of the granite of this region' (p. 174) and described some transitions of the coarse granite and its enclaves of older rocks. He rightly pointed out that all the dark rocks marked by Ball on his map as 'syenite' (in the modern sense) should be considered as granodiorites (p. 135); true syenites being almost absent.

Ball's and Barthoux's Memoirs contain a detailed megascopic and microscopic description of many rock types. Their views on the area continued to dominate on all subsequent writers. *Andrew* (1934, p. 106) remarked that diorites occurred at Aswan in the form of intrusions into a country rock of psammitic and semipelitic schists and gneisses with interbedded hornblende-biotite-andesine-quartz schists which may represent basic igneous rocks, but in some cases show traces of sedimentary origin. These diorites had suffered regional metamorphism together with the country rock prior to the intrusion of the coarse porphyritic granite. *Hume* in his great complied works on the geology of Egypt (1934 - 1935) reviewed earlier literature on Aswan in great detail but added little on the subject and his main views appear to be similar to those of Ball. He envisages a great mass of hornblende granite passing by insensible gradation into a subsidary granodiorite and the whole mass rising through a group of gneisses and schists (1934, p. 50; 1935, p. 354) *Little and Attia's* report on the development of the Aswan area (1943) includes a review of earlier literature but their report also contains a new generalised geological map (scale 1:25.000) covering a wider area to the east than that covered by Ball's map.

As is well known to visitors of Aswan, all the igneous and metamorphic rocks, except some of the late basic dykes, are mostly remarkably peneplained and overlain by an almost horizontal thick series of 'Nubian Sandstone' of Cretaceous age but all recent writers agree that the older underlying rocks are of pre-Carboniferous if not Pre-Cambrian age. Hume (1935, p. 652) considered the granite as late Pre-Cambrian and he appeared earlier (1932) to have correlated the country rock of Aswan vaguely with the Dalradian of the British Isles. Thus the orogeny at Aswan might be provisionally fixed as equivalent to the Caledonian of Western Europe.

Recently the present writer completed a detailed new geological survey of the Aswan area (scale 1:10.000) covering an area a little larger than that covered by Ball's map and roughly bounded by longitudes 32° 51' E and 32° 56' E and latitudes 24° 6' N and 23° 59' N. A reduced version of this new geological exposure map is represented by fig. 3 but figs. 1 and 2 give a general and summerised idea about the distribution, structure and origin of the main rock types (excluding the Nubian Sandstone and younger deposits) of the whole area surveyed.

Field evidence together with laboratory studies had led the writer to *new conclusions concerning the origin and evolution of the igneous and metamorphic rocks of the area.* The biotite and hornblende schists represent a thick series of geosynclinal sediments and associated basic igneous intrusions that were drastically folded and sheared while acid igneous liquids highly injected them. After the orogeny, active replacement and granitisation of the country rock by the acid material took place and culminated in the production over a wide area of the coarse Aswan granite which must thus be considered as mainly of metamorphic origin though large parts of it had moved. The fine grained granite and the basic minor intrusions, followed later and were separated by a period of local shearing faulting and jointing. They are of direct magmatic and igneous origin. The terms 'magma' and 'igneous' are used here in H.H. Read's sense (Read, 1943).

The failure in the past to distinguish between the different foliate and linear features of the rocks and to correlate them with their respective episodes, especially in the southern part of the area where late shears are numerous, as well as the frequent presence in the coarse Aswan granite of large relics and inclusions of the country rock representing intermediate stages of granitisation had led formerly to confusion in working out the history of the area. Such relics and intermediate stages of granitisation were labelled syenites, diorites, granodiorites, 'black granites' etc. and were treated as if they were distinct igneous intrusions or differntiates from magmatic melts.

In the light of these new findings, the igneous and metamorphic rocks of the area are described below under the following titles which are arranged as far as possible in a rough chronological order.

This treatment which entirely differs from that of previous writers gives a logical and clear picture of the evolution of these rocks.

1. *The country rock*; old geosynclinal sediments and associated basic igneous intrusions.
2. *Orogenic deformation* of the geosynclinal material accompanied by intrusion of *acid igneous fluids* which were contemporaneously deformed but their intrusion survived long after the orogeny.
3. *Progressive metamorphism and granitisation of the country rock* caused by the acid igneous fluids.
4. *The coarse Aswan granite* culminating from(3).
5. Intrusion of the *New Granite.*
6. *Pegmatites and aplites* of the area (of different ages).
7. *Late shearing lines and belts* especially in the southern part of the area.
8. *Late minor intrusions.*

1. THE COUNTRY ROCK

The country rock originally included a thick geosynclinal sedimentary series of alternating semipelitic, pelitic and much subordinate psammitic bands into which were intruded numerous small sills and dykes of basic igneous composition. Original carbonate bands are almost absent from the map-area while sedimentary beds of basic tuffs and ashes may have been present but had become almost indistinguishable from the original fine grained basic sill intrusions owing to their subsequent regional metamorphism. Because of this metamorphism it is also impossible to ascertain the metamorphic contact-effects of the early basic igneous intrusions on the sediments but probably these were negligible. As far as can be judged from the least metamorphosed varieties of the old basic intrusions they appear to have been all of gabbroic composition being made up almost entirely of pyroxene and basic plagioclase (at present acid labradorite) with subordinate ilmenite, the first two making about 53 and 42 respectively of the percentage modal composition (see mode A, Table III). Their grain size varies and ranges from very fine in the small intrusions (as if they were originally chilled) to moderate or coarse (average diameter up to 5 mm.) in the larger in-

trusions. The latter are seen in some cases to pass into finer grained varieties at their outer borders. Original subophitic and doleritic textures can sometimes be still found in both the coarse and medium grained intrusions.

2. OROGENIC DEFORMATION OF THE GEOSYNCLINAL SEDIMENTS AND ASSOCIATED BASIC INTRUSIONS ACCOMPANIED BY INTRUSION OF ACID IGNEOUS MATERIAL.

Subsequent to the intrusion of the basic igneous rocks into the sediments all of them were subjected to strong orogenic forces which threw them into intricate folds of every description and impressed on them most of the foliar planes of the present day country rock. During this diastrophism, acid pegmatite-looking material was intruded into the deformed rocks in the form of small sheets, sills and veins a few feet to few inches thick. Their contemporaneous age with the deformation is proved by their equal folding and deformation with that of the associated banded rocks and sometimes they are drawn into separate lenses and boudins between which the country rock flowed (fig. 4). The incoming of such acid material into the country rock must have survived long after the diastrophic episode as practically everywhere in the long exposure of country rock east of the Nile, the latter is veined by two kinds of acid intrusions : an early one sheared and deformed and a later of nearly the same material but unsheared and crossing the former kind in irregular dykes and veins, sometimes tortuous. The form of the later post-diastrophic intrusions became gradually, however, less discrete and more diffuse. In other words, they became more intimately mixed with the country rock as the latter became gradually more heated and it is beliveed that active chemical replacements and reconstitutions between them and the country rock had led to the regional metamorphism and in intensified cases to the granitisation of the area as will be described.

The importance of such early discrete acid permeations is twofold. First, they indicate beyond doubt that the subsequent metamorphic and granitic changes started with a really *liquid* material which was capable of intrusion in the form of sills, dykes and veins

into the country rock. Second, they indicate the chemical composition of such material. They are typically coarse and pegmatite-looking and are made up almost entirely of quartz, potash feslpar and unzoned oligoclase. In a good part of the earliest and most strongly sheared intrusions, the felspar is entirely oligoclase (e. g. Modes A and B, Table I) but commonly in later intrusions potash felspar appears and even exceeds the oligoclase (e.g. other modes in Table I). Typically these acid intrusions are devoid of any ferromagnesian minerals and when these occur they are usually in subordinate amounts (below 2 % in the discrete ones, Table I) and are probably due to contamination from the adjacent country rock. The accessories are mainly biotite, rare garnet, hornblende sphene, apatite, muscovite and opaque ores. These acid permeations are thus made up almost entirely of silica, alumina, alkalies and water vapour. They were at first sodic, then sodi-potassic.

3. PROGRESSIVE METAMORPHISM AND GRANITISATION OF THE COUNTRY ROCKS

The effect of the continued introduction of such acid material mostly in a diffuse manner particularly along intergranular boundaries of the country rock is indicated in the initial stages by the gradual development of oligoclase and then of potash felspar porphyroblasts in the banded sediments and associated basic intrusions now represented respectively by biotite and hornblende schists and gneisses and the gradual elimination of pre-existing structures culminating in the passage of the country rock over wide areas to the coarse grained porphryoblastic granite or granodiorite. The earlier intermediate stages of these alterations are to be seen in the country rock proper while intermediate and final stages are found in the country rock in the vicinity of the main granite and in many places within the coarse granite itself when the later has a mixed or migmatitic appearance with abundant relics of the pre-existing country rock revealing all stages of its evolution.

A.—METAMORPHISM AND GRANITISATION OF THE SEMIPELITIC, PELITIC AND PSAMMATIC COUNTRY ROCK.

1. As said above the country rock proper is abundantly traversed and veined by the afore mentioned acid intrusions and is in variable

degrees of intermixture with it. What can be taken as the earliest stages of alteration of the pelites and semipelites available in the map-area is represented by dark or grey biotite-schists made up of a fine grained mosaic of quartz and felspar which, except in the more psammitic varieties, is already dominantly if not entirely oligoclase (see modes A, B and C, Table II). The latter may make up to 55% of the modal composition of the rock. Average grain size is usually well below 0.3 mm. and the quartz-felspar mosaic is traversed by small subaligned biotite flakes that give the schistosity to the rock.

2. In a further stage there is a general coarsening of the constituent minerals (through coalescence ?) but some of the oligoclase grains distinctly grow in size with respect to the other constituents and become rather oval or subhedral. In doing so, they appear to replace the matrix mosaic along their outer borders in a sinuous and sutured manner (fig. 5) as had already been demonstrated by Read from Cromar, Aberdeenshire (Read, 1927, p. 325, fig. 30) and from Central Sutherland (Read, 1931, p. 124). Occasionally these enlarged oligoclase grains poikiloblastically enclose the matrix minerals. As the oligoclase porphyroblasts continue to grow in size lamellar twinning as well as oscillatory zoning (never of a wide range of composition) become more prominent and two or more porphyroblasts which had initially grown near each other may meet and form a single large crystal of a clumsy construction (fig. 6). In composition the oligoclase usually ranges from intermediate to basic oligoclase, in few cases acid oligoclase. The biotite also builds larger but fewer flakes than before and becomes segregated in the spaces between the felspar porphyroblasts thus framing them and enhancing their outline. In doing so, the biotite flakes lose their original subparallel arrangement.

During the early stages many of the felspar porphyroblasts grow with their longer axes parallel to the schistosity planes, and there is no indication of any contemporaneous or late cataclasis forcing them to do so. This orientation must thus be simply a preferred one along planes which afford the least resistance and at the same time the maximum supply of incoming ingredients for the growth of the porphyroblasts. In advanced stages this orientation usually becomes confused and the original regional foliation is thus swamped and lost or it may faintly persist as a relict foliation or lineation even to the most advanced stages.

3. Potash felspar (microcline-microperthite) characteristically makes its appearance late after the oligoclase; at first in tiny hair like intergranular films (fig. 7) which then expand poikiloblastically replacing most of the matrix minerals but especially attacking the already formed large oligoclase crystals which they either replace in a very irregular manner or simply surround by an outside mantle, and soon build more robust and larger crystals than those ever attained by the oligoclase. With the increase in potash felspar myrmekite in fantastic shapes makes its appearance and apparently increases proportionally. Its amount seems to be in reverse order to that of the perthite veins traversing the potash felspar. With increase of potash felspar, large patches and islands of coarse quartz also develop and further developments along these lines with the total destruction and replacement of the original finer matrix-mosaic lead to rock types identical to the coarse Aswan granite. Sometimes even in the advanced stages a perfectly normal-looking granite reveals in thin section microscopic relict-patches of the pre-existing fine grained mosaic in the spaces between the large (about an inch long) felspar crystals.

4. Table II gives the modal compositions of various semipelites to pelites in different environments. Microscopic sillimanite fibres sometimes develop in the early intermediate stages and appear as if they are rising from the biotite flakes which they do sometimes interleave (Modes A and B, Table II). Large garnets (up to 6 mm. in diameter) are also numerous at some localities (e.g. mode G, Table II) and appear to replace the matrix minerals and the biotite which they enclose poikiloblastically. Accessory minerals include apatite, zircon, sphene, ilmenite, magnetite, colourless epidote and allanite. There is an indication of their appreciable increase together with rare new small plates of hornblende in the intermediate and more advanced stages as in the relics within the granite. Similarly, radioactive ingredients as judged by the dark haloes in biotite, increase and broaden in the advanced stages though on the whole they are not quite frequent even in the coarse granite itself. On the other hand, tourmaline is remarkably absent in all stages of alteration of the country rock as well as from any other igneous or metamorphic rock variety of the whole Aswan area. It appears that boric ingredients were totally absent in the original acid permeations.

5. When the rocks are not affected by the late shears, hydrothermal features such as the alteration of felspar to sericite, biotite to chlorite and vermiculite and the development of secondary muscovite are rather few and mild and appear to affect more the earlier and more schistose stages than the later stages of the country rock. This is probably due to the presence of schistosity planes along which the hydrothermal solutions can most easily enter.

The few psammitic and granulitic bands are made up of a very granular mosaic, almost felsitic (average diameter of grains from 0.07 to 0.12 mm.). They present an alteration similar in principle to that of the pelites and semipelites but judging by the amount and character of their relics in the migmatitic granite they definitely lag in their rate of granitisation much longer than the other sediments. They also differ from the pelitic and semipelitic bands by the presence of some grains of potash felspar in their mosaic at a relatively early stage as compared with the associated semipelites. In higher stages, biotite, oligoclase, potash felspar and the rest of accessory minerals are introduced.

While the distribution of the above different stages throughout the country rock proper appears to be quite patchy and irregular; in all probabilities due to an original likewise patchy distribution of the incoming acid material that is mainly responsible for their development, it must be remarked that :

i. Within the country rock proper (fig. 1) the oligoclase porphyroblasts usually do not attain sizes larger than 5 mm. in length except when within a few hundred yards from the main boundary of the coarse granite. This boundary is highly irregular in detail and almost transitional with the country rock (fig. 3). Within this range potash felspar when developed exceeds 1 cm. or more in length.

ii. Within the north-south stretch of the country rock there is an indication of a progressive increase in the above described metamorphic and granitic stages as we go southwards. Thus the country rock to the north, except in the vicinity of the granite, is of finer grain and rather more oligoclasic than the coarser and relatively potash felspar-richer gneisses of the south.

iii. The character of the contact of the coarse granite with the country rock also varies from north to south. In the north it tends to be transtional and gradual with the familiar features of granitised terrains (e.g. development of 'dents de cheval' and granitic patches in the bossom of the country rock as well as the occurrence of structurally undisturbed relict inclusions of the country rock within the granite). South of El Shellal, however, the outer contact of the same granite with the country rock opposite to it, appears to be sharp and intrusive-like even though the country rock adjacent to it is, as said in (*ii*), in a more advanced stage of metamorphism than to the north. This is explained below in connection with the coarse granite.

B.—PROGRESSIVE METAMORPHISM AND GRANITISATION OF THE OLD DOLERITES

1. The earliest stages in the metamorphism of the old dolerites and gabbroic intrusions are to be found all over the long strip of country rock proper north of the latitude of the dam. These intrusions are, however, more abundant in the country rock between the latitudes of Sehel Island and the dam. As said earlier, in some of the relatively coarse varieties original colourless pyroxene and labradorite in subophitic relation can be still found though the pyroxene is usually largely in uralitic pseudomorphs and tends to be replaced by a pale green hornblende while the labradorite becomes clouded except along its outer margin where it becomes slightly acidic.

2. In further stages the whole structure becomes gradually granular and the plagioclase recrystallises into more or less clear and sharply twinned rounded grains of labradorite while the pyroxene completely gives place to granular pale hornblende of slightly smaller size than the original pyroxene. At few places of such granular mosaics of pale hornblende and basic plagioclase, the percentage of the amphibole falls down to 10 % of the mode of the rock (e.g. mode D, Table III) and it is probably such varieties that Barthoux had called 'anorthosites'. Whether these are due to original variation in the gabbroic magma or to seggregational metamorphic processes or otherwise is not clear though the first alternative is the more

probable. In some cases these pale rocks show an original banded appearance : the lighter hornblende-poor bands less than an inch to two inches thick or more alternate with the darker bands rich in hornblende. The total volume of such rocks, is, however, quite small and their relation in the field to the normal varieties is not clear. A crude foliation is usually persistent in all of them.

In the coarser varieties, the hornblende is usually without good crystal outline but the plates are not sieved much by other minerals.

3. In subsequent stages, the hornblende becomes darker in colour and the plagioclase more acidic till it reaches andesine or basic oligoclase and in doing so many of its grains grow in size. Granular quartz starts also to appear and the opaque minerals, mostly ilmenite, alter along their outer borders to pale botryoidal sphene. These rocks represent the 'diorites' of previous writers (e.g. mode G, Table III).

4. Plagioclase continues to grow up in characteristically clumsy and irregularly oscillatory zoned porphyroblasts. Potassic ingredients first make their appearance in the conversion of part of the hornblende into large biotitic flakes and books and then as in the semipelites, in very thin intergranular films of potash felspar (fig. 7 B) that begins to replace other minerals especially the oligoclase and grows into large porphyroblasts. The amount of accessory minerals greatly increases. Sphene builds large (up to 3 mm.) well defined rhombic plates almost to the disappearance of the enclosed opaque granules. Large apatite crystals become abundant at a rather early stage. Small idiomorphic crystals of bronwnish yellow allanite with numerous zones of growth, sometimes with an outer zone of colourless epidote become frequent.

The rocks at this stage present a peculiar appearance of a 'dark porphyroblastic granite' consisting of large white or red felspar eyes sparsely set in a dark matrix of a finer grain made up of plagioclase, hornblende, biotite, quartz and the accessories. Ball called such rocks 'Syenites' in the 1907 Memoir. Although in the field they may in few places pass by that name, microscopic evidence shows that the amount of plagioclase with or without quartz is still high enough for such rocks to be called so and as Barthoux (op. cit., p. 135) had stressed, the term granodiorite is much preferred

(fig. 8). The large dark granodiorite exposure about a kilometre south of Aswan town and east of the Aswan-dam motor road is most probably a relic of an old large sheet intrusion of the dolerites that has reached the above mentioned stages of metamorphism and granitisation (fig. 3).

5. By further increase in potash felspar and quartz and reduction of hornblende and biotite the rocks pass to the characteristic coarse granite of the area. The old gabbros and dolerites must thus have passed by dioritic and then granodioritic stages before they become granites. The later granodioritic ('syenitic') stages are almost restricted to the numerous relics of dolerite within the migmatitic granite in which it is never rare to find most of the above described progressive stages in crude zones around least altered cores of metaolerite. In rare cases (on Sehel Island) angular dark relics of metadolerite are found in the granodiorite and give it an agmatitic appearance.

The foregoing description of the progressive metamorphism and granitisation of the dolerites and gabbros applies particularly to the coarse grained varieties but in those of finer grain (below 0.1 mm. in diameter in their earliest stages and most probably representing the originally chilled outer margins or small basic intrusions) the alteration follows not a much different trend but the rate of this alteration appears even to be faster than in the coarse equivalents. Thus at an early date they become rather richer in quartz, biotite, potash felspar and deeply coloured but highly sieved plates of hornblende. This is again probably due to the usually well developed foliation planes which acted as easy channel for the introduction of the acidic ingredients. This foliation becomes then gradually obliterated and finally lost as the felspar porphyroblasts grow in size. Figs. 9 A, 9 B and 9 C illustrate the development of such large felspar porphyroblasts in an originally fine grained metadolerite.

In few places outside the migmatitic granite, the hornblendic schists when strongly veined by acid material, develop numerous garnet porphyroblasts up to 1 cm. in diameter. These probably owe their existence to both the country rock and the introduced acid material as Read (1931, pp. 136, 138) and others had shown from Sutherland. Garnets, however, were not observed in the hornblendic relics within the granite.

In some dark relics in the coarse granite about the centre of its southern part (at a latitude just south of that of the dam), the hornblende appears to be partly converted into large plates of a light green pyroxene ($Z^\wedge C = 40°$) different from the original pyroxene found in the country rock. This must indicate an alteration distinctive of high temperatures (cf. Harker, 1939, p. 285 and Sutton and Watson, 1951, pp. 275, 281). This observation is important as bearing on the more advanced nature of the migmatitic granite in its southern part as will be shown later.

The above main changes clearly indicate an increase in silica and alkalies both of which are characteristic of the acid intrusions described before and from which they were certainly derived. In fact such acid veins can still be seen in frequent discrete to cloudy-like permeations within the interior parts of the metadoleritic inclusion in the granite. Lime is the most important ingredient to be driven out during these alterations, particularly from labradorite as it changes to oligoclase. A small part of this lime is retained by the titania of ilmenite to form the large sphenes and another part is fixed in apatite while the frequent development of large repakivic porphyroblasts* of felspar in the outer zones of such hornblendic relics and in the coarse granite enclosing them most probably points out to the basifying effect of the outgoing lime and its entrance in the oligoclase porphyroblast-building ingredients of the outer zones. The basifying effect of the granitised metadolerites is also remarkedly reflected on the metamorphism and granitisation of the pelites and semipelites (or their relics) in their vicinities whereby the already formed large potash felspar porphyroblasts become distinctively rapakivic (fig. 11).

Beside illustrating this late basification, this observation also points out to the lag in the rate of granitisation of the metadolerites

* It must be remarked that not all the numerous rapakivis of the area are of such an origin although they are mostly so. Some of the white outer coats of the rapakivi, whether complete or incomplete, turned out under the microscope to be made up of tiny late myrmekite aggregates (fig. 10) probably of perthitic nature and may be due to ex-solution. In other cases, differential and irregular replacement of the oligoclase porphyroblasts by the late potashfelspar may result in a rapakivi-looking porphyroblasts, though usually in such cases the latter show in handspecimen a very irregular distribution of white and pink patches.

as compared with the pelites and semipelites. This lag can be demonstrated in hundreds of places within the migmatitic granite. There, the great majority of the relict country rock inclusions belongs to the metadolerites while the semipelites and pelites that must have associated them had already or almost disappeared and passed to granite. Even, most of those few relics which were taken in the field to be of pelitic or semipelitic parentage indicated under the microscope a psammitic origin. Sometimes, as in the northern parts of the granite, the sediments are converted to granite while the old basic intrusions cutting them lag behind and remain almost intact and appear as if they were really cutting the granite (all their pyroxene is, however, converted to hornblende), e.g. fig. 12. The explanation is simple. The pelites and semipelites having a chemical composition nearer to that of granite than the metadolerites and psammites are more readily granitised than the latter.

In Table III is given several modal analyses of metadolerites in different stages of alteration while Table IV gives the modal composition of some typical granodiorite-looking rocks before they finally change to the coarse granite of the area.

4—THE COARSE ASWAN GRANITE

This is the famous monumental rock of which many of the huge ancient Egyptian monuments and obelisks were cut out. As implied from the foregoing, the present writer believes that this granite is largely of metamorphic origin and represents the culmination of the alteration of the country rock just described and still in many parts of its outcrop presents a very heterogeneous and highly migmatitic appearance (figs. 1 and 3) with plenty of small relics of the country rock. As said before, these relics mostly belong to the metadolerites because of their lag during granitisation. To the south and to the east, relict inclusions in the granite largely disappear (fig. 1) and the latter becomes clear and homogeneous for rather long stretches and it is there where most of the quarries are situated.

The typical Aswan granite is made up of large euhedral crystals of potash felspar, often an inch long or more and distinctly Carlsbad twinned, crowded together and have their colour and shape enhanced by a dark matrix of quartz, oligoclase, hornblende, biotite, sphene

and apatite (fig. 13). The modal amount of biotite and hornblenbe usually do not fall beyond 5 % of the mode of the rock. Horndlende is usually a typical accessory but in sparse grains though it may altogether disappear. The large potash felspars and occasionally the smaller oligoclase ones may still show some replacive features. In Table V are given four modal analyses of typical specimens of this granite from different localities. Because of the coarseness of the rock these analyses must be considered as rough and approximate.

It should be noted that during the granitisation of the country rock, apart from the influx of silica, alkalies and alumina of the oriiginal acid intrusions into the country rock, an important part of these ingredients as well as others like lime, titania, magnesia and ron involved in these alterations (for example in the granitisation of semipelites and psammites) were provided on the spot by the country rocks themselves (here the metadolerites) while the ionised water vapour of the acid permeations simply acted as carrier of these ingredients as well as a medium for ionic interchange and recrystallisation. The basic ingredients just mentioned were originally concentrated in the old basic intrusions (the metadolerites) but tend finally to be homogeneously distributed in the perfectly granitised stretches. Cataclastic or shearing stresses are on the whole completely relaxed or absent during these alterations and should not be confused with the local and quite late shearing belts which affect certain parts of the area shearing this granite as well as the New Granite.

As would be expected from a metamorphic granite, its mineralogical and chemical analyses may vary in different parts or patches but the two last chemical analyses published by Barthoux (1922) and Harwood (1935) do not markedly differ from each other in their more common ingredients (these authors do not indicate the exact localities of their analysed specimens).

The homogeneous granite itself is rarely free of planar or linear elements mostly caused by the crude alignment of the large felspar crystals. Even in field exposures which fail to show this, large polished blocks cut from the same localities reveal them clearly. This linear feature represents *either* relict regional foliation of the granitised pre-existing foliated country rock and caused by the preferred orientation during growth of many of the felspar porphyroblasts along pre-existing schistosity planes *or* direct planar flow of the constituents of the granite in the advanced rheomorphic stages as is explained below.

While the granite is considered as originally of metamorphic origin and had evolved in place of the country rock, yet in many places mostly to the east and south there are indications that the metamorphic granite has become *mobile* and flowed like a magma (in Read's sense, 1944, a moving migma as some of the constituent minerals and relics must have been still in the solid state). This mobility most certainly was largely due to huge influxes of the acid plutonic fluids.

To bring up clearly the contrasting characters of the autochthonous granite (largely evolved in situ) to the north and that of the mobilised granite to the east and south, evidence for each is given separately below but it must be kept in mind that the demarcation line between the two kinds of granites shown in fig. 1 is quite arbitary and in the field as far as exposures indicate there is complete and insensible gradation between the two types and no sharp boundaries exist. Further, in the northern part rheomorphic features had definitely occurred in quite a good number of isolated pockets and patches where granitic processes looked to be rather advanced. Also, it is quite possible that fluid material (whatever its origin may be) from different parts of the still solid country rock, to seggregate together into larger granite-looking pockets.

Evidence for the largely autochthonous nature of the granite in the northern part of the area is as follows :

i. Transitional passage of the country rock to the granite and the development of apparently completely isolated large felspar porphyroblasts, sometimes rapakivic, as well as granite-looking patches right in the midst of the country rock. This, however, usually happens within the country rock a few hundred yards from the main migmatitic boundary. Similar transitional boundaries are also to be found between the granite and its relict inclusions.

ii. Replacement features observed in the different stages of alteration and can be easily demonstrated in thin section (e.g. figs. 5, 6, and 9). These features have already been described.

iii. The preservation and coincidence of the original linear features of the country rock in completely isolated relict patches within the granite with those of the country rock outside it even though this linear trend may cross at a large angle the main boundary between the granite and the country rock. Thus the NNW regional trend of foliation and fold axes of the country rock exposed northeast and east of Aswan town is preserved in the coarse granite south of Aswan as a weak relict lineation and is of course continued in the inclusions therein (fig. 2).

iv. The lag in the rate of granitisation of the metadolerites with respect to the pelites and semipelites associated with them resulted in many cases of the complete passage of the latter into granite while the former were little affected and remained as 'unsupported' inclusions in the granite, sometimes preserving their original positions (fig. 12). Thus some of them occur as long rather straight dykes or sheets several yards in the granite and indeed at first glance they appear as if they were post-granitic intrusions and may even be mixed with the real late dioritic or more basic intrusions had they not been traversed by thin felspathic veins of the granite and when followed along their exposure they are sometimes found to pass into angular inclusions within the granite. The best places to illustrate these observations are to be found on the Island of Sehel and in the migmatitic granite on the mainland opposite to it.

Though the granite to the south and east looks exactly the same as the granitic parts of the migmatite to the north and no sharp boundaries occur between them, yet there are indications that the granitisation and influx of acid fluids were much more intense in the former parts and that the granite produced there attained a higher degree of homogeneity* and a kind of fluidity which enabled it to move. The subject of rheomorphism and mobilisation in granitised terrains has already been discussed by Read (1944) to whom the reader is referred.

* The high degree of homogeneity of the granite may not be solely produced by advanced granitisation alone but may also be helped by rheomorphism and flow which may accompany advanced granitisation. Rheomorphism and flow will help to fliter the fluid parts of the migma-magma from the still solid and suspended country rock relics by the lag or crowding of the latter at preferential places in the course of flow or uprise of the rheomorphic mass. Similarly any relief of pressure at the top or anywhere at the sides of a migma-magma will certainly tend to attract the more fluid fractions from all over the migma-magma and hence these fractions will blend and crystallise into a more homogeneous state than their parent material.

Evidence for rheomorphism of the granite to the east and south in the Aswan area can be summed up as follows :

i. Though as said earlier the country rock in contact with the granite in the south shows more advanced migmatitic features than to the north, yet its contact with the granite as exposed south and east of El Shellal (e.g. at Jebel Shishi) is rather sharp and abrupt. The same holds true to most of the inclusions occurring in this part of the granite. This is probably due to motion of the 'softened' granite caused by the influx of the acid fluids and solutions. This motion would tend to drag away any transitional material formed along the contact of either the main mobilised granite with its country rock or with its inclusions. Even in some hornblendic relict inclusions within the granite and traversed by small granitic veins there is a suggestion that some of the oligoclase porphyroblasts, originally formed within the relic like those of fig. 9, look as if they were being dragged out into the veins (crystal stoping ?).

ii. The relative decrease in number of inclusions, which moreover always belong to the more resistant metadolerites, and the subsequent homogeneity of the granite to the east and south indicate that, if this granite were of metamorphic origin, a very advanced stage of granitisation must have been reached: a stage in which the acid permeating fluids had their fullest play and most probably had done much to render the granite mobile and cause it to behave like a straightforward igneous intrusion. This intensified granitisation is reflected in the opposite country rock there as is said in (*i*).

iii. The intensity of these metamorphic changes in the south is also reflected in the conversion of some of the hornblende in the resistant metadolerite inclusions to light green pyroxene. This conversion was not observed in similar relics of the northern part.

iv. What may be taken as an indication that parts of the granitised rocks have actually become fluid even in patches in the northern parts of the granite is the occurrence of large crystals of oligoclase

with an outer coating of potash felspar side by side with true rapakivic ones already mentioned around granitised hornblendic relics. The latter had developed mainly as porphyroblasts in the solid rock while the former had probably directly crystallised from the liquid parts and so followed the normal order of crystallisation, with oligoclase crystallising first and mantled from outside by potash felspar crystallising next. Such zoned crystals, however, are not common and usually each kind of felspar crystallises separately.

v. A good indication of movement of the granite to the south and east is the contrast in trend of the linear features of each country rock inclusion in the granite with respect to the regional linear trend of the country rock proper outside the granite as well as between the different individual inclusions. Some of these inclusions lie in the granite with their foliation planes almost horizontal while in the country rock proper such a horizontal or low lying foliation is absent. The granite itself in its southern half may show a planar flow structure independent in trend from that of the country rock proper (fig. 2).

From the above evidence it is thus reasonable to consider the granite to the south and east as originally derived from a strongly granitised country rock that was capable of flow rather than from a direct igneous intrusion that had at its notrhern end partially replaced the country rock. In fact the fairly homogeneous granite to the east and south might represent the crystallised liquid fraction that had flowed out and separated from the pasty migmatitic 'mess' to the northwest and elsewhere.

5.—THE NEW GRANITE

After the diastrophism, metamorphism and granitisation followed a period of relative quiteness to be interrupted later by the intrusion of the New Granite in irregular dykes and sheets of moderate to small dimensions (figs. 15 and 16). These intrusions traverse all older rocks and sometimes cut from them angular inclusions. Intrusions of the New Granite are particularly more concentrated in the western half of the map-area.

The New Granite itself is a fairly homogeneous biotite-granite almost aplite-looking as it is usually fine grained (average grain diameter below 1 mm.). When not traversed by late shear belts it is unfoliated and Rosiwal analyses of that granite from different intrusions all over the area give very near results which probably indicate that they had arisen from one common magma (see Table VI). The average percentage modal composition is : quartz 30.28, oligoclase 30.50, potash felspar 27.77, myrmekite 5.03, biotite and chlorite after it 5.67, secondary muscovite 0.59 and 0.16 of minor accessories mostly tiny granules of magnetite, zircon, apatite and allanite. The total amount of accessory minerals is much less than those of the coarse granite. Compared with this latter granite, replacive features between the mineral constituents of the New Granite are almost absent and they appear to have crystallised out independently from a magma (fig. 14). Unlike the large, sometimes clumsily constructed and irregularly zoned plagioclase of the coarse granite, the oligoclase (here about Ab_{80} An_{20} in composition) forms well defined euhedral crystals of uniform composition though usually there is an inner much sericitised core and a small outer zone of slightly different composition than the main body of the crystal.

The outer contacts of the New Granite, whether straight or meandering are always sharp and the contact effects on older rocks are quite negligible. It is thus a typical late anatectic granite and is igneous in the fullest meaning of that word.

Besides the fine grained intrusions, there appears to be a rare coarse variety of about the same mineral composition (see Table VII). Only four of such intrusions were found in the map-area cutting the migmatitic old granite; the longest of these intrusions starts just north of the British military cemetry about a kilometre and half southwest of Aswan town and runs northwards for about 300 yards (fig. 3). This granite may represent a rare slightly earlier phase of the New Granite and may be called here provisionally as the *Intermediate Granite* but in the field there is no definite indication of the age relation between these two granites; and the Intermediate Granites may even stand for crystallised fluid material that thad occupied well defined tracts (e.g. comparatively large opening gaps) or intruded into the migmatites during the granitisation.

6. PEGMATITES AND APLITES

These belong to several episodes. The pre- and syntectonic acid permeations, mostly pegmatite-looking have been already described. Pegmatite-aplite intrusions contemporaneous with the granitisation and succeeding it are frequent : the former are to be found irregularly cutting and veining the large relict inclusions of the country rock within the granite while the latter traverse the granite as well as its inclusions (Table I). Such intrusions would be difficult to distinguish from each other in the country rock proper but they clearly cut the earlier much sheared and the unsheared white (oligoclasic) permeations. Sometimes these late pegmatites are garnet or muscovite-bearing while excellent coarse and fine graphic structures between potash felspar and quartz are developed in others.

Pegmatite intrusions subsequent to the New Granite are, however, almost rare. Even aplitic intrusions become few and the New Granite itself is only in few cases seen traversed by such aplite dykes (Table VIII).

Broad comparison of thse pegmatite-aplite intrusions from different episodes indicate that younger intrusions are distinctly more potassic and of finer grain. The fine grain is probably due to a gradual fall of gaseous and fugitive constituents which must have been consumed largely in the earlier intrusions and helped them to travel far outward into the country rock. The wide difference in grain size between the two granites (figs. 13 and 14) of the area also reflects this although of course each granite might have evolved separately and in a different manner.

7.—LATE SHEARINGS

Strong shear lines, mostly along minor fault planes, are not scarce in the area and their rough trend appears mostly to be E.-W. swerving northwards or southwards. Such shear lines frequently mark the loci of strong late hydrothermal activities and the fractures may be filled by silica (quartz or botryoidal chalcedony) and/or calcite. The granites and gneisses might be strongly kaolonised while, when

such shear lines traverse some of the old basic intrusions in the country rock at the eastern boundary of the map-area, they are converted into antigorite and tremolite or to vermiculite skarns.

In the area south of the dam these late shears become more frequent, widen and change into shear belts (especially about the latitude of El Hesa Island and south of it). It is open to question whether such late shear belts in the south represent stresses that were responsible for the 'squeezing out' and intrusion of the New Granite into the older rocks to the north or whether the intrusion of this granite and the shearing were two independent actions. In the sheared porphyroblastic gneisses of the country rock to the south, the augen or eye structure becomes more pronounced as the felspar porphyroblasts pass into porphyroclasts. In these parts, distinction between the country rock gneisses and the fine grained granite in intrusions interbedded with them becomes rather difficult and perhaps only recognisable by the paler colour of the latter.

8.—LATE POST-GRANITE MINOR INTRUSIONS

Late intrusions of several small but well defined igneous bodies of intermediate to basic composition dissect all the above mentioned rocks. Some of these are lightly strained but the majority of them is unfoliated. Petrographically they are divisible into several kinds of lamprophyres (mostly camptonites with about 50 % felspar and 47 % of a red brown amphibole of a small extinction angle), porphyrites, bostonites, diorites and dolerites. They occur in irregular branching intrusions and necks but the majority occurrs in well defined two sets of parallel dyke swarms the more important of which runs in a NEE-SWW direction while the other runs in a roughly N-S direction and is sometimes amygdaloidal. All these late small intrusions usually occupy tensional joints, faults, local fractures and other weak planes. The sorting out of these different and numerous intrusions in the field is not always easy and the different varieties were probably intruded at different dates but as some of these intrusions seem to occupy fault planes that run in the plutonic rocks as well as the Cretaceous Nubian Sandstone overlying them (e.g. the very conspicuous fault line subparallel to the dam and to the

NE of it) and are consequently later than both* while other intrusions, especially the diorites, stop short of the Nubian Sandstone. There is thus the possibility of at least two broad sets of intrusions older and younger and should the older set of these intrusions be connected with the plutonic activities of the area described above, they might possibly represent several and variable degrees of contamination of the country rock and granites into a rising simatic basic material. The detailed petrographical description of such intrusions and their correlation with others from different localities of Egypt are intended to be considered separately in a future publication. Figs. 17 and 18 sum up the trends of jointing and late dyke intrusions in Aswan.

Economic prospects of the igneous and metamorphic rocks of Aswan :

The prospect of discovering any workable ore minerals in the plutonic rocks of the map-area surveyed are almost nil for two reasons:

i. absence of such minerals in the original rocks themselves.

ii. absence of any mineralisation in what may be taken roughly as the pneumatolytic stage (e.g. that of the intrusion of the plutonic acid solutions) as well as in the hydrothermal stages.

The already mentioned scarcity of pleochroic dark haloes in the biotites of the area may be taken as a crude indication of the insignificant presence of radioactive ingredients. Recent investitions by the Egyptian Survey on this subject appear to have yielded negative results.

The present day use of the plutonic rocks as source for kaolin, ornamental and building stones appears to be all that can be made with them. Some of the tough fine grained and almost black metadolerites of the area would provide an ideal crushed material for the construction of modern motor roads.

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* Professor A. Rittmann of Cairo University kindly informed the writer that he had discovered a multiple dyke at Jebeltogok occupying a fault plane that crosses both the plutonic rocks as well as the overlying Nubian Sandstone.

SUMMARY AND CONCLUSIONS

The series of geosynclinal sediments and associated early basic intrusions were strongly deformed by orogenic forces. At the decline of the orogeny intrusion of acid fluid material that had started earlier continued to permeate the country rock at first in discrete veins and later in a more diffuse manner and brought about the granitisation of the country rock in places where they had most intensely opearted.

Granitisation was at first largely in situ, as it remained in the northerly parts of the present granite but in the more advanced cases such as to the east and south the resulting granite actually flowed and thus had destroyed in these places much of the evidence for its metamorphic origin.

Apart from the limited number of ingredients supplied by the acid material, these ingredients as well as others involved in the granitisation processes were provided on the spot by the country rocks themselves and there is, apart from the extensive development of oligoclase in the country rock neither any indication of regional 'basic fronts' as has been suggested to occur in some comparable terrains nor is there any need to call on for hypothetical supplies from deeper horizons. The dark hornblendic ferromagnesian-rich clots frequently found in some parts of the granite are not to be explained as indication of the existence of any such fronts or as segregations of basic ingredients expelled and not required by the granitised rocks. They are, as already stated, mostly metadoleritic inclusions after the old basic intrusions that had lagged in their granitisation and in many cases relics of their original textures and structures are still preserved. Likewise, small dark biotitic selvedges to felspathised and granitised patches of the country rock cannot be attributed to any large scale basic front but are simply a logical temporary by-product in the intermediate stages of granitisation and would completely disappear when granititisation is completed.

The actual replacements of a rock-variety by another during these alterations mostly occurred through introduction, exchange or expulsion of ions into the crystal lattices of the solid grains of the country rocks *through the medium of liquid films* occupying

intergranular spaces as well as any available planes in the atomic lattice of each individual grain.*

After the granitisation and mobilisation of the granitised country rock a period of quiteness followed. Then granitic activities were renewed in direct igneous intrusions usually of a fine grain. The occurrence in a region of an earlier migmatic granite and a later intrusive granite had long been demonstrated from many terrains. This duality of character in the granites has recently been a subject of discussion by Read (1949, pp. 143-151) in his contemplation of time in plutonism, whereby new granites arise from the old.

Late shears followed† and then igneous activity was renewed in the form of intermediate to basic minor intrusions.

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* The high content of oligoclase in the least altered semipelitic country rocks available in the map-area (e.g. the first three modes of Table II.) indicates that there are still less altered stages of the country rocks expected to occur outward to the north and east in the country rock still farther from ths migmatites, outside the limits of the present map-area. As said, their high soda-content owes its ultimate origin to the early sodic pegmatite permeations while some fixations of Na, Ca, Fe, Mg and other cations that might outgo from the adjacent or nearby migmatites to the west and southern might have also occured. The amount and outward extent of these border enrichments in the country rock are still unknown as their effects extend beyond the northern and eastern limits of the present area.

In general, the mineral assemblages of the country rocks and their relics in the granites, correspond to Eskola's amphibolite facies except in some relics in the southern half of the area where assemblages corresponding to the pyroxene-hornfels facies occur.

† Beside the late belts of shearing responsible for the diversion of lineations in the country rock of the middle and southern parts of the area (fig. 2), this diversion might have been caused in part by some temporary pressing effects of the mobilised uprising migma (under tectonic or isostatic adjustments) against its walls.

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TABLES

In the following tables chlorite whenever present is after biotite and so its amount is added to that of biotite as the chlorite is usually rare.

Table I.

Modal compositions of some discrete acid permeations.

	A	B	C	D	E	F	G	H
Quartz	47.67	33.10	31.45	46.14	24.88	26.50	32.39	28.44
Plagioclase	48.94	66.42	36.57	43.16	15.10	47.15	37.87	38.38
Pot. Felspar	—	—	29.11	8.35	51.05	18.94	25.81	28.09
Myrmekite	—	—	2.13	0.81	7.59	2.96	2.32	3.04
Biotite	1.81	0.48	—	1.54	1.38	4.45	1.20	2.05
Garnet	1.43	—	—	—	—	—	—	—
Opaques	—	—	—	—	—	—	0.41	—
Sericite	0.15	—	0.74	—	—	—	—	—
Sphene	—	—	—	pres.	—	—	—	—
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The first three modes belong to the early pre-tectonic permeations in the country rock of the north-eastern corner of the map-area. Mode D belongs to tortuous ptygmatic veins permeating the country

rock near the ruins of Mishek on the eastern bank of the Nile south of El Shellal. The last four modes belong to permeations contemporaneous to the granitisation episode of the country rock's relict inclusions from different parts within the coarse granite.

Table II.

Semipelitic hosts and their migmatitic derivatives

	A	B	C	D	E	F	G	H	I
Quartz	30.36	33.64	36.97	30.43	21.43	29.09	31.85	20.67	28.45
Oligoclase	49.84	50.88	42.23	51.60	55.77	37.70	42.77	54.71	31.80
Pot. felspar	—	—	0.12	—	0.17	13.61	—	6.67	26.28
Myrmekite	—	—	—	—	—	2.52	—	0.40	6.64
Biotite	17.39	11.66	19.81	15.81	22.44	15.21	15.10	15.05	6.64
Sericite	—	—	—	1.96	—	1.87	4.95	—	0.05
Apatite	0.23	pres.	0.87	0.17	0.19	—	0.58	0.51	0.11
Sphene	—	—	—	—	—	—	—	1.99	—
Opaques	—	—	—	0.03	—	—	0.59	—	0.03
Epidote	—	—	—	—	—	—	pres.	pres.	—
Allanite	—	—	—	—	—	—	—	—	—
Garnet	—	0.86	—	—	—	—	4.16	—	—
Sillimanite	2.18	2.96	—	—	—	—	—	—	—
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

	J	K	L	M	N	O	P	Q
Quartz	28.90	25.43	44.84	39.22	30.88	24.90	29.25	32.26
Oligoclase	33.71	29.64	44.63	34.85	40.04	30.53	46.07	31.74
Pot. felspar	28.29	32.62	1.76	16.55	13.35	37.37	4.52	26.00
Myrmekite	0.45	1.88	—	1.97	0.38	1.74	pres.	3.11
Biotite	6.99	10.21	8.77	6.57	12.21	5.39	19.65	6.68
Sericite	1.66	—	—	0.84	—	0.07	—	—
Apatite	—	0.07	—	—	0.33	—	0.51	—
Opaques	—	0.15	—	—	1.15	—	—	0.14
Allanite	—	—	—	—	0.27	—	—	0.07
Sphene	—	—	—	—	1.39	—	—	—
Garnet	—	—	—	—	—	—	—	—
Sillimanite	—	—	—	—	—	—	—	—
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The first three analyses are from semipelitic biotite-schists from the north-eastern corner of the map-area. They present the lowest stage of metamorphism available in the area. Modes D to H represent semipelitic gneisses near the eastern border of the map-area (fig. 1) and are arranged from north to south. Modes I to N belong to relics from many parts inside the migmatitic granite, while the last three modes are those of coarse gneisses about to pass to the coarse granite.

Table III.

The metadolerites in different stages of alteration

	A	B	C	D	E	F	G	H
Pyroxene	53.71	—	—	—	33.96	—	—	—
Quartz	—	—	—	—	1.00	13.53	3.42	20.92
Plagioclase	41.61	74.15	67.76	85.36	46.26	45.93	50.25	39.12
Pot. Felspar	—	—	—	—	2.56	1.02	—	1.19
Myrmekite	—	—	—	—	—	—	—	—
Hornblende	—	24.65	31.71	14.64	13.17	14.75	29.81	19.01
Biotite	3.27	1.20	—	—	0.27	23.19	14.78	17.55
Sphene	—	—	—	—	—	pres.	0.62	0.44
Opaques	1.41	—	0.53	—	2.78	0.66	0.46	1.34
Apatite	—	—	—	—	—	0.92	0.66	0.43
Allanite	—	—	—	—	—	—	—	—
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

	I	J	K	L	M	N	O	P
Pyroxene	—	—	—	—	—	0.35	—	—
Quartz	16.66	24.11	18.64	18.08	21.50	17.77	29.90	16.71
Plagioclasse	41.37	41.97	49.04	39.71	48.05	36.09	32.02	41.93
Pot. felspar	—	15.35	14.39	2.83	7.31	4.68	23.47	7.56
Myrmekite	—	—	0.26	—	0.13	0.15	1.24	0.38
Hornblende	26.29	7.57	3.67	13.65	10.95	18.09	0.91	1.36
Biotite	12.12	8.17	12.03	23.81	10.45	18.88	11.11	28.68
Sphene	3.56	0.79	0.48	0.36	0.06	0.62	1.02	2.66
Opaques	—	0.63	0.65	0.86	0.94	1.47	0.33	0.28
Apatite	—	1.41	0.84	0.22	0.61	1.90	pres.	0.44
Allanite	—	—	—	0.48	—	—	—	—
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

	Q	R	S	T	U	V	W	X
Pyroxene	—	—	—	—	—	—	—	—
Quartz	25.86	20.47	21.20	30.24	20.68	20.64	22.31	14.92
Plagioclase	34.95	36.41	40.88	38.94	38.89	34.73	34.21	50.31
Pot. felspar	27.48	18.13	17.16	16.11	11.53	12.57	18.31	1.17
Myrmekite	1.12	—	1.17	0.69	pres.	0.28	1.89	1.13
Hornblende	—	12.00	2.43	2.32	13.47	11.09	7.57	11.39
Biotite	9.81	12.60	14.75	10.81	13.72	19.66	13.64	19.14
Sphene	—	—	1.23	—	0.53	0.15	0.49	1.00
Opaques	0.76	0.39	—	0.35	0.79	0.88	0.48	0.57
Apatite	0.02	—	0.46	0.08	0.39	—	1.10	0.37
Allanite	—	—	0.72	0.46	—	—	—	—
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Modes A to D represent the least metamorphosed basic intrusions available in the country rock proper at the north-eastern corner of the map-area. In mode A the original pyroxene is largely uralitised. Modes B and D represent the 'diorite' and 'anorthosite' of previous authors. Mode E and F are from inclusions within the granite about the centre of the area while modes G and H belong to similar inclusions within the granites of Biga and Saluja Islands respectively. Mode I represents a metadolerite with numerous oligoclase porphyroblasts at the main boundary between the granite and the country rock east and about the latitude of Jebeltogok on the Nile.

Modes K to Q belong to differently metamorphosed and felspathised metadolerite inclusions in different parts of the granite. In N, near Kuti on the Nile south of Cataract Hotel, rare relics of the original colourless pyroxene still persist inside the hornblende. Modes P and Q belong to one relic in the centre of the granite about the latitude of Mesitot on the Nile. Q represents a relatively more advanced stage than P.

Modes R to X belong to relatively more advanced relics and inclusions. In R, S, T, and W the rocks contain large felspar porphyroblasts and represent some of the 'black granites' of Barthoux or 'syenites' of Ball. They are described here as granodiorites. R from Sehel Island, S from Saluja Island, T south of Aswan town,

U and V around the Coast Guard Station near Jebeltogok, W from the centre of granite about the latitude of Mesitot and X from near the Ajarma ruins on the eastern bank of the Nile near the southern end of the map-area, fig. 1. The rock of the last mode looks like a typical light coloured hornblende gneiss.

Table IV.

The intermediate granodiorites

	A	B	C	D	E	F	G	H
Quartz	20.47	19.46	26.04	23.92	21.20	22.31	27.72	23.24
Plagioclase	36.41	55.43	44.29	37.69	40.88	34.21	27.71	31.90
Pot. Felspar	18.13	15.69	16.56	10.55	17.16	18.31	35.41	20.52
Myrmekite	—	1.81	1.72	0.38	1.17	1.89	1.91	—
Hornblende	12.00	2.60	2.41	6.87	2.43	7.57	—	—
Biotite	12.60	5.01	7.54	18.60	14.75	13.64	5.52	21.60
Sphene	—	—	1.44	0.18	1.23	0.49	1.31	0.91
Opaques	0.39	—	—	1.60	—	0.48	—	1.83
Apatite	—	—	—	0.21	0.46	1.10	—	—
Allanite	—	—	—	—	0.72	—	0.42	—
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

These are intermediate products of the granitisation of the country rock, mostly the metadolerites. They are the 'syenites' of Ball and occur as dark patches within the coarse granite. The above analyses must be considered as approximate because of the large grain size of these rocks.

Modes A, E and F are those of R, S and W of Table III and their provenances are indicated there. B from opposite the British military cemetry, C from Jebeltogok, D from relics in the centre of the granite about the latitude of Mahatta, G from south of Aswan town east of Cataract Hotel and H from about 700 metres south-west of the unfinished obelisk.

Granodiorites of modes G and H are about to pass to the coarse granite in the field.

Table V.

The Old Granite

(Coarse Aswan Granite)

	A	B	C	D	E
Quartz	23.20	32.85	24.40	24.91	27.72
Oligoclase	19.38	27.58	26.67	19.86	27.71
Pot. felspar	46.65	29.25	44.38	45.17	35.41
Myrmekite	5.60	3.09	1.31	4.07	1.91
Biotite	5.17	7.23	2.96	5.10	5.52
Hornblende	—	—	—	0.65	—
Sphene	—	—	0.28	—	1.31
Opaques	—	—	—	0.24	—
Allanite	—	—	—	—	0.42
	100.00	100.00	100.00	100.00	100.00

A and B belong to the granite at the eastern border of the map-area at about the latitudes of Koror and El Shellal respectively, C from the granite near the unfinished obelisk, D from about half a kilometre east of Mesitot on the Nile and E south of Aswan town, repreated from G, Table IV.

Because of the coarseness of these rocks, the above analyses must be considered as approximate.

Table VI.

The New Granite

(The fine grained granite)

	A	B	C	D	E	F
Quartz	29.12	34.11	34.00	33.80	25.45	25.20
Oligoclase	30.76	27.52	34.54	28.89	30.02	31.26
Potash felsp.	31.28	27.26	20.29	27.24	29.58	31.00
Myrmekite	4.19	3.84	3.73	6.20	6.74	5.46
Biotite	4.06	5.62	7.44	3.87	5.93	6.08
Muscovite	0.59	1.45	—	—	0.65	0.85
Others *	—	0.20	—	—	0.63	0.15
	100.00	100.00	100.00	100.00	100.00	100.00

All muscovite in this table is secondary. The rock of mode A comes from a small intrusion, east of Sheikh Fatha, B from the large dyke intrusion of Sehel Island (figs. 1 and 15), C from an intrusion on the western part of Saluja Island containing some metadolerite inclusions, D from a small intrusion east of the British military cemetry, E from a large sheet intrusion on the western bank of the Nile south of the dam and F from a place near that of E but belongs to a small dyke intrusion.

Table VII
An Intermediate Granite ?

	A	B
Quartz	31.11	34.62
Oligoclase	34.78	32.24
Pot. Felspar	29.03	24.29
Myrmekite	2.19	1.57
Biotite	2.83	7.28
Sec. Muscovite	0.06	—
	100.00	100.00

Mode A belongs to the long intrusion at the British cemetry and trending north-south, (see fig. 3).

Mode B belongs to a small intrusion of granite cutting the coarse migmatitic granite and its metadolerite inclusions near the motor road between Aswan and the dam at about the latitude of Arakin.

Table VIII.
The Latest Acidic Intrusions

	A	B	C
Quartz	39.94	36.49	40.45
Oligoclase	58.64*	26.23	24.55
Pot. felspar		35.25	32.68
Myrmekite	—	1.65	1.77
Biotite	0.40	0.09	—
Muscovite	1.02	0.29	0.42
Opaques	—	—	0.13
	100.00	100.00	100.00

* Oligoclase and potash felspar are dificult to measure separately because of the very fine grain of this rock.

Mode A belongs to a single small aplite dyke that cuts the New Granite intrusion near Selekia, north of Koror, Mode B to a small aplite intrusion near the Block House ruins west of El Shellal and mode C belongs to a small aplitic intrusion west of the Haggana's camel stable on the motor road between Aswan and the dam.

EXPLANATION OF FIGURES

(The microphotographs were kindly prepared by Mr. Ahmad Ezzat of the Geology Department, Alexandria University)

FIG. 1.—A generalised sketch-map of the pre-Nubian Sandstone rocks of the Aswan area. Small intrusions of the New Granite as well as all the late minor intrusions are omitted. The country rock of biotite and hornblende schists and gneisses is represented by horizontal lines. Inclined lines stand for the autochthonous coarse granite and crossed lines for the mobilised parts of it. Where the coarse granite looks in the field to be relatively homogeneous (e.g. when inclusions and relics of the country rock in it become few or rare) the lines are closer to each other than in the mixed part. Large intrusions of the New Granite are solid black. The boundary line between the authochthonous granite and the mobilised granite is arbitary as there are insensible gradations between them. Mobilised patches and small pockets within the autochthonous granite are not indicated so as not to complicate the sketch.

FIG. 2.—The structural features of the country rock and the granite as well as those of relics of the former within the latter. Notice the usual coincidence of lineations in the upper half of the area and their divergence in the lower half.

FIG. 3.—Geological exposure map of the Aswan area. (Large map at end.)

FIG. 4.—Early or pre-tectonic acid igneous sill intrusions boudinaged and equally folded with the enclosing semipelitic schists of the country rock at the north-eastern corner of the map-area of fig. 1. The semipelitic matrix flows into the spaces between the boudins.

FIG. 5.—Definite replacive features of a newly forming small oligoclase porphyroblast (centre of photograph) in a semipelitic gneiss from the country rock at the north-eastern corner of the map-area. The outer boundary of the porphyroblast is remarkably sutured and wavy (especially where indicated by arrow) while tiny relict inclusions of quartz grains and biotite flakes originally belonging to the replaced matrix still survive inside the porphyroblast. The mode of this rock is represented by column D, Table II. (Crossed nicols, X40).

FIG. 6.—A 'clumsy' porphyroblast of oligoclase (centre of photograph) growing in a semipelitic gneissose relic in the granite about 1 1/2 kilometres south of the village of Mahatta indicated in fig. 3. This porphyroblast is built up by the meeting and coalescence of two smaller porphyroblasts (a and b). In actual detail each of these is still made up of small patched grains differently zoned and of variable chemical composition. (Crossed nicols, X20).

FIGS. 7 A AND B.—First appearance of potash felspar (solid black and heavy black lines) in the metamorphosed semipelitic gneisses and the metadolerites. It characteristically occupies intergranular boundaries in thin films and patches, particularly where small oligoclase porphyroblasts are concentrated and becomes rare in the more quartzitic patches, e.g. fig. 7A. Oligoclase is lightly lined, biotite and hornblende densely lined while quartz is clear. Fig. 7A from a semipelitic gneiss from the country rock of the map-area a little north of the latitude of the dam. (X 22.) Fig. 7B from a fine grained metadolerite relic in the coarse granite of Sehel Island. A large clumsy oligoclase porphyroblast occupies most of the right half of the figure. (X41.)

FIG. 8.—A general view of a slice of the so called 'syenite' actually a dark granodiorite and is a stage in the granitisation of metadolerites. The rock consists of plagioclase (greyish and clouded), biotite and hornblende (both dark), quartz and some potash. felspar. Mode W, Table III. From large relics in the centre of the area. (Ordinary light, X 10.)

FIGS. 9A. 9B AND 9C.—Development of small and clumsy plagioclase porphyroblasts and their growth in fine grained metadolerites.

Fig. 9A shows two porphyroblasts variably clouded. Their outline is made more visible by Indian ink. From a metadolerite inclusion in the granite of Biga Island. (Ordinary light, X 10.) Fig. 9B shows one clumsy felspar prophyroblast forming in a fine grained metadolerite just at the main boundary of the country rock with the coarse granite south of Aswan town. The porphyroblast is made up of several patched grains of oligoclase (in parts clouded), microcline and myrmekite as well as embayed surviving inclusions of the replaced matrix, mostly quartz and biotite (Ordinary light, X 20.) Fig. 9C is that of fig. 9B but is photographed under crossed nicols to show clearly the microcline (m) and the myrmekite and the complex nature of the porphyroblast.

FIG. 10.—Part of a large microcline porphyroblast (dark) with small inclusions of oligoclase crystals formed earlier. The microline grain replaces the matrix of a semipelitic relict in the granite about the centre of the area. Aggregates of myrmekite grains line the outer border of the large microcline plate. (Crossed nicols, X 20.).

FIG. 11.—Part of a typical large rapakivic porphyroblast developing in a fine grained semipelitic relic in the vicinity of an altering metadolerite. The potash felspar core is slightly of clumsy construction and encloses earlier partly replaced oligoclase porphyroblasts. The outer oligoclase mantle (dark and clouded) replaces the matrix poikiloblastically and is probably due to late lime-bearing ingredients introduced as a consequence of the late alteration of the neighbouring metadolerite. A small felspar porphyroblast occurs to the right. From the permeated country rock to the east about the latitude of the dam. (Ordinary light, X 10.).

FIG. 12.—A small relatively undistrubed fine-grained metadolerite relic in the coarse granite of Sehel Island with ancient Egyptian inscriptions on it. It represented originally a small basic igneous intrusion, about a foot and half thick, into the semipelites. The latter had completely altered to granite while the basic intrusion had lagged behind.

FIG. 13.—The coarse Aswan granite. Parts of the large microcline crystals (m) are seen together with wide quartzitic areas (qz) and small oligoclase crystals (o). Compare the grain size of this rock with that of the New Granite of fig. 14 (Crossed nicols, X 10.).

FIG. 14.—The New Granite. Same magnification as fig. 13. From the relatively large intrusion of fig. 15 on the Island of Sehel. The mode of this rock is represented in column B, Table VI. (Crossed nicols, X 10.).

FIG. 15.—The large New Granite intrusion on Sehel Island with ancient inscriptions on its blocks. See figs. 1 and 14.

FIG. 16.—A sheet intrusion of the New Granite (foreground) into the Old coarse granite (dark background) in the southern half of the area. Both kinds of granite weather differently; the New Granite when slightly sheared looks on weathering surfaces as if it were a sedimentary gneiss.

FIG. 17.—The approximate trend of jointing in Aswan. As the number of bearings taken on excellent joints is not large the general trends shown should be considered provisional till more future bearings are amassed. (45 readings.).

FIG. 18.—Trends of the late minor dyke intrusions in Aswan. (140 readings.).

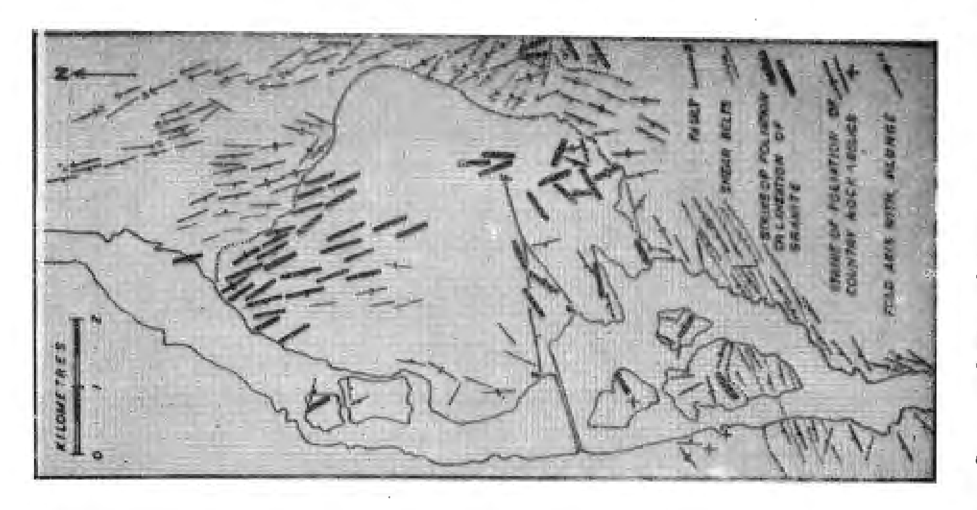


Fig. 2.— Structural Map of Aswan area, simplified from the Geological Map. (Reproduced from Gindy, 1954, Geol. Mag., vol. 91, p. 487, London).

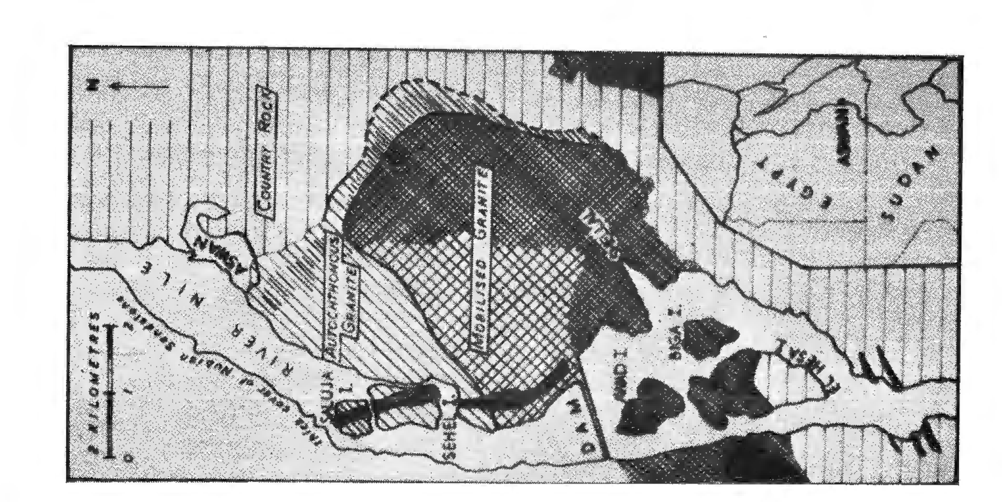


Fig. 1.— Simple sketch of the Pre-Nubian solid geology of Aswan area. (Reproduced from Gindy, 1954, Geol. Mag., vol. 91, p. 486, London).

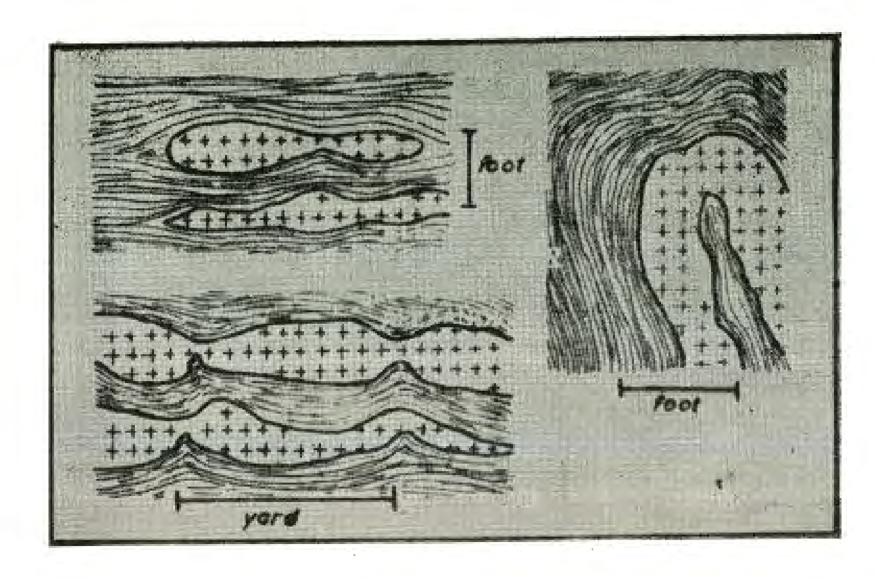


Fig. 4.— Early pre- and para-deformation pegmatitic intrusions (not replacements) in semipelitic country rocks.



Fig. 5.— Embayments of quartz by early replacive oligoclase in a semipelite (X 40).

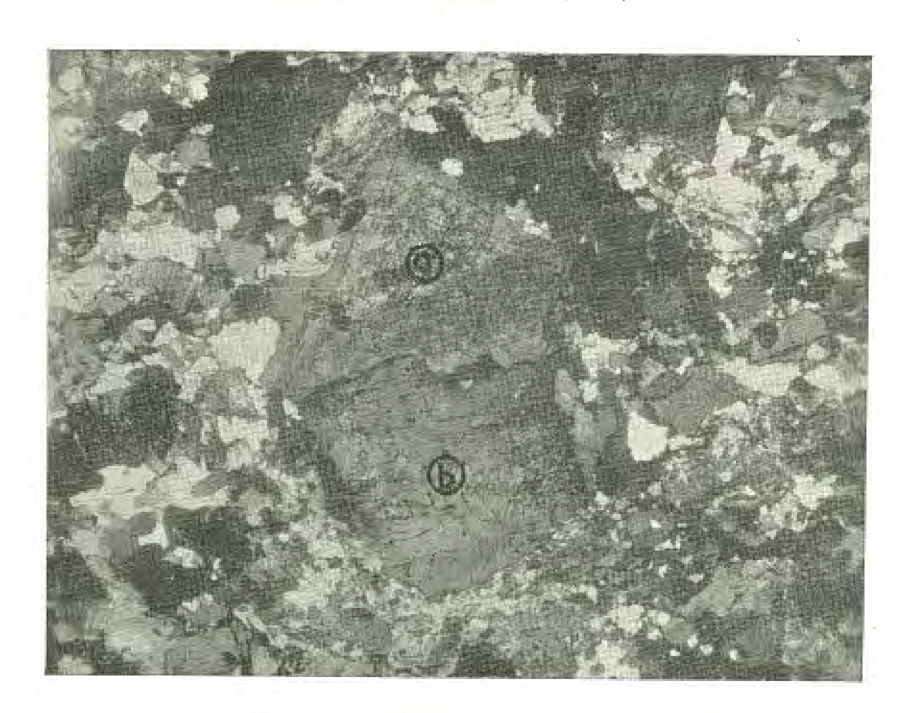


Fig. 6.— Patched oligoclase porphyroblast in a semipelitic gneissose relic in the Old Granite (X 20).

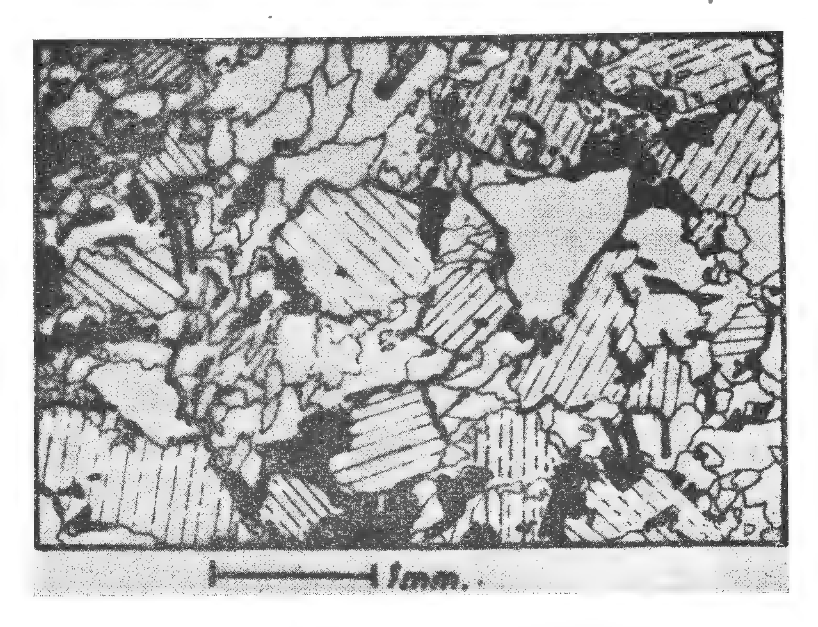


Fig. 7A.— Microcline (black) replacing oligoclase formed earlier in a semipelite.

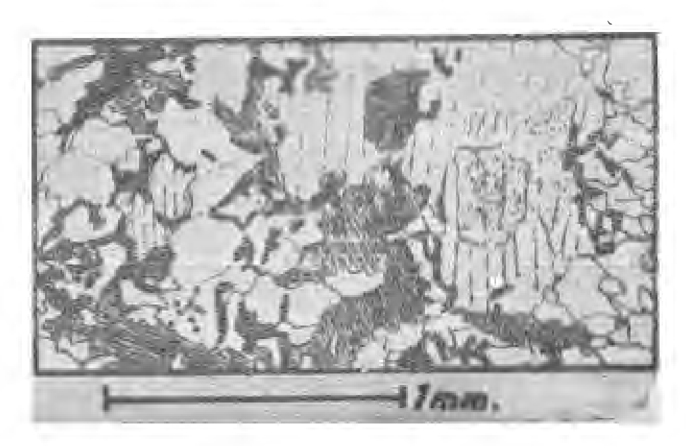


Fig. 7B.— Microclinic introductions replacing plagioclase in a metadolerite.



Fig. 8.— Fine to medium grained granodiorite (felspathised and modified metadolerite). X 10.

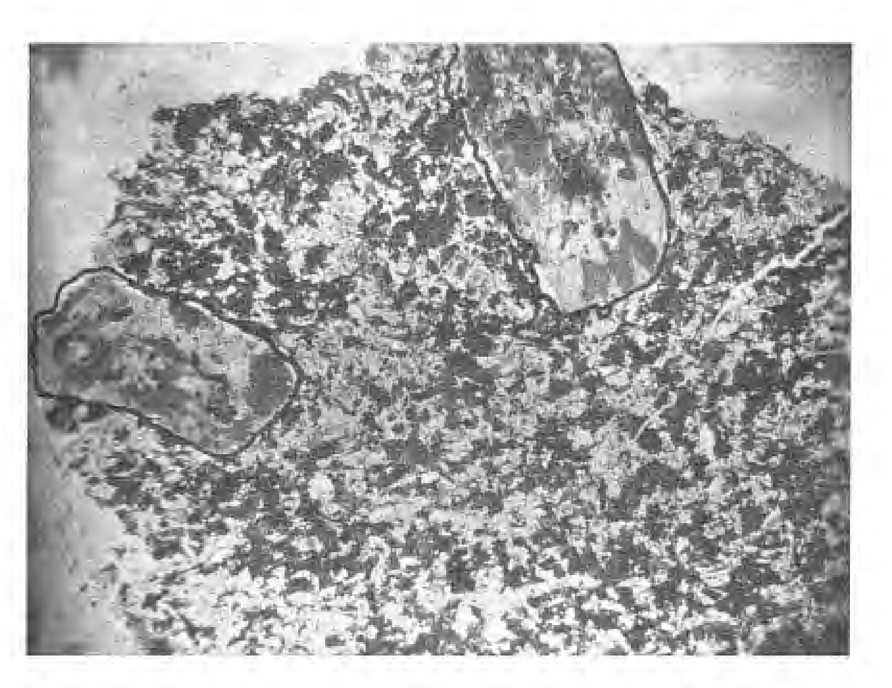


Fig. 9A.— Plagioclase porphyroblasts in a modified metadolerite. (X 10).

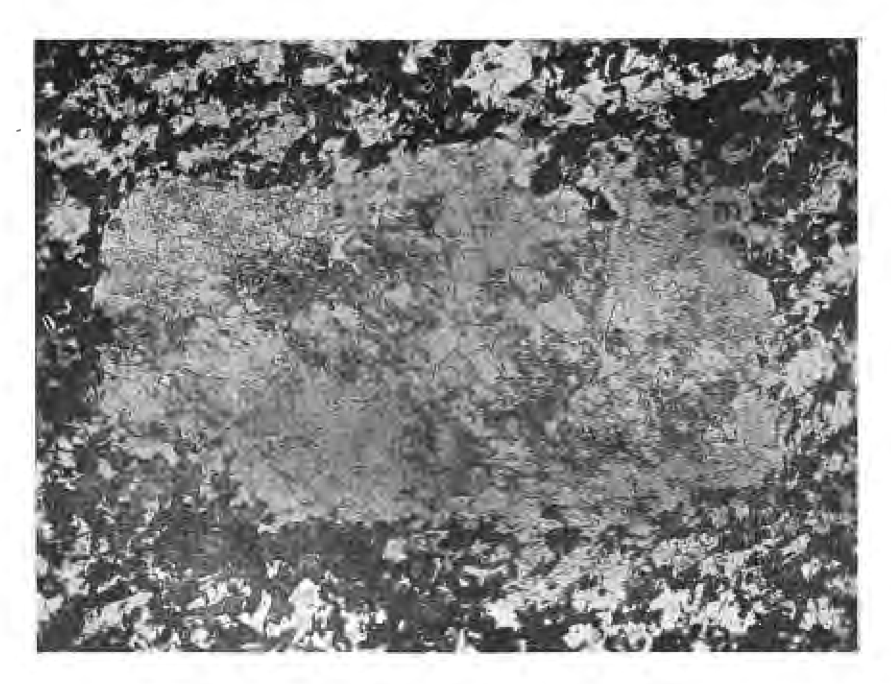


Fig. 9B.— Detail of one porphyroblast similar to those of fig. 9A. (X 20).

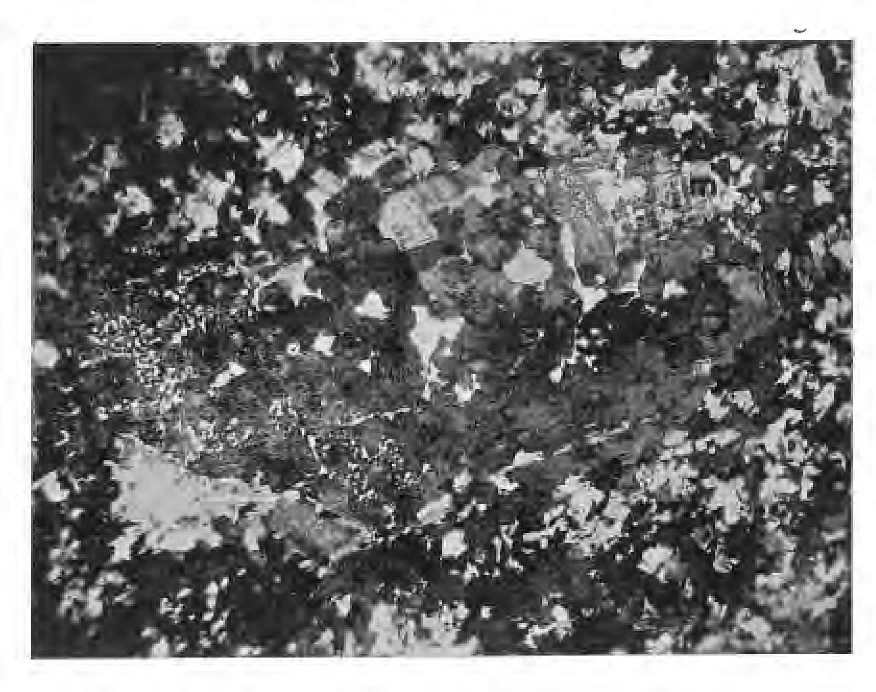


Fig. 9C.— Same view of fig. 9B but under crossed nicols to show complicated replacive structure.

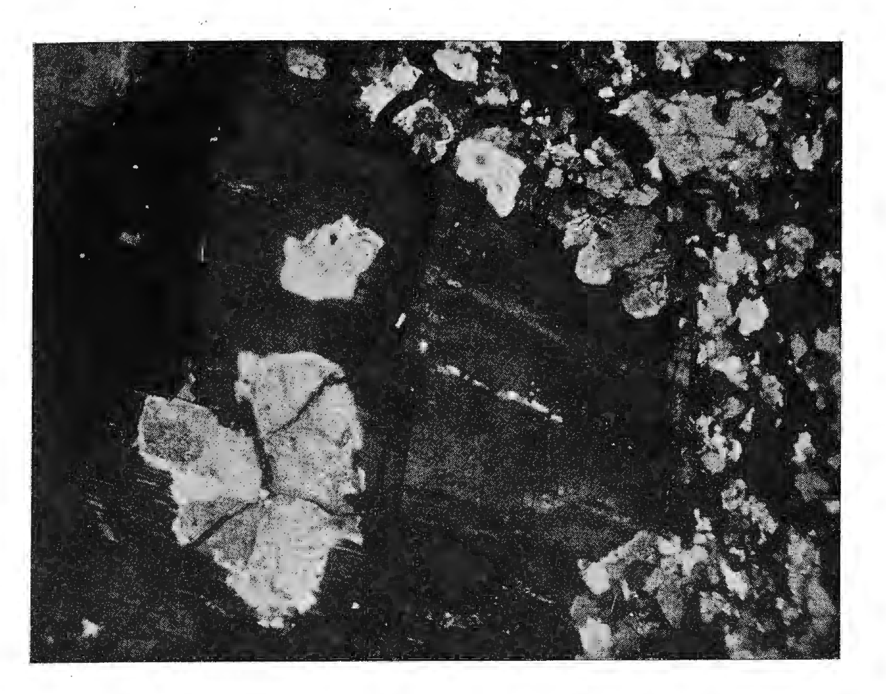


Fig. 10.— Part of a rapakivi-like felspar; plagioclace rim made up of myrmekite aggregates. Crossed nicols. (X 20).

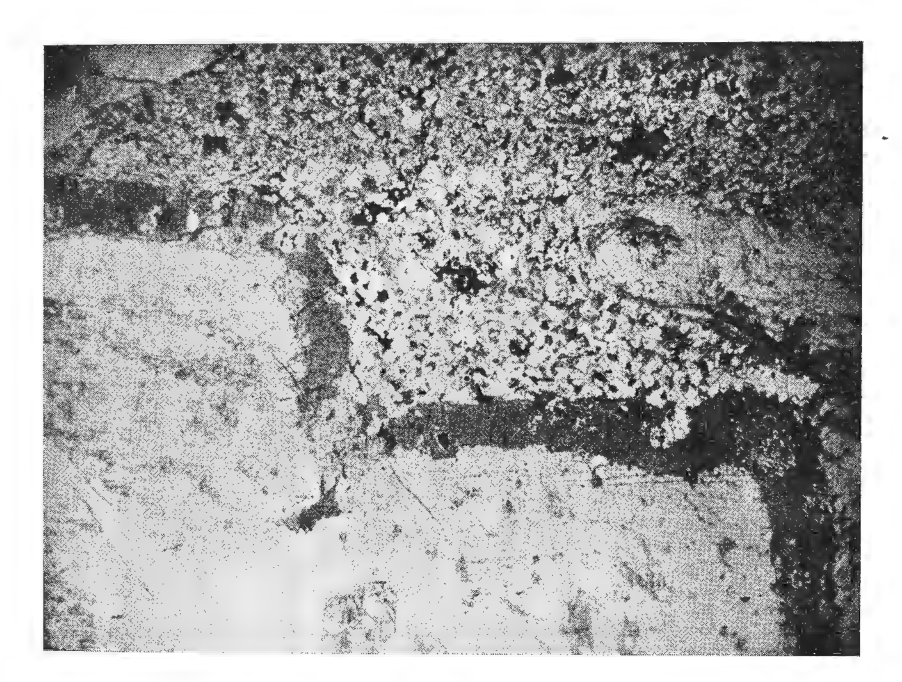


Fig. 11.— Part of a large typical Rapakivi felspar with an outer rim of plagioclase (darkened and clouded by alteration). Matrix is still fine grained with biotite and hornblende. (X 10).



Fig. 12.— Dark relics of a metadolerite intrusion preserved almost in situ within the Old Granite that had preferentially replaced the semipelitic country rock of the basic intrusion.

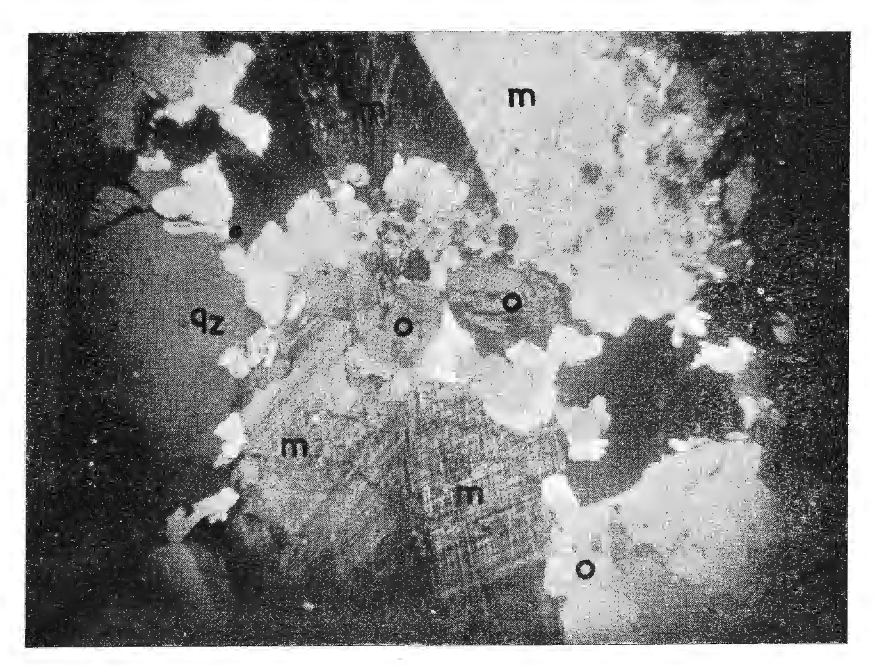


Fig. 13.— Typical Old Granite (coarse variety] Grossed nicols, (X 10).

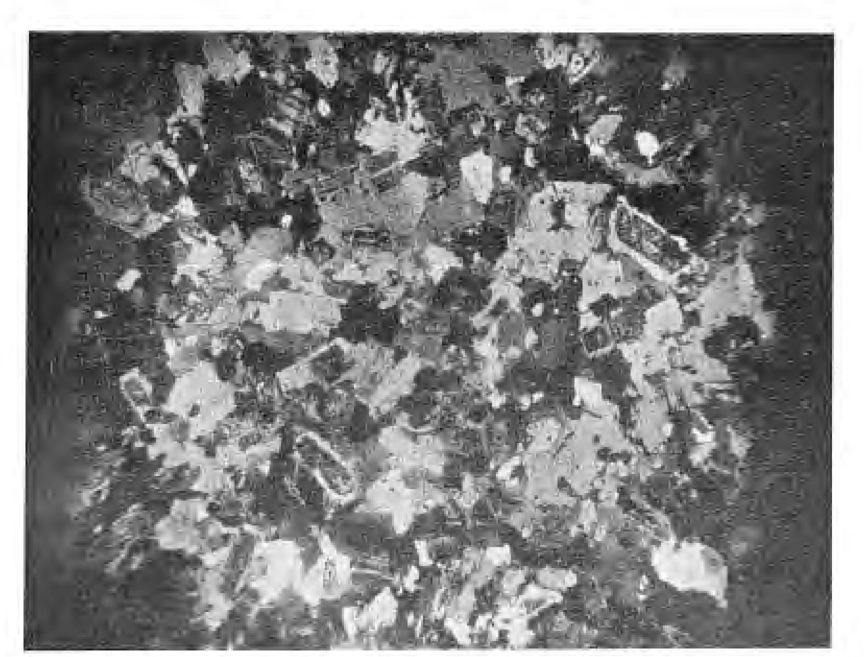


Fig. 14.— Typical New Granite (probably evolved at depth by anatexis from the migmatites and old Granites). Grossed nicols, (X 10).



Fig. 15.— Large dyke intrusion of the New Granite on Sehel Island. See Geological Map.



Fig. 16.— Differential weathering of Old (coarse) Granite in background and New Granite intrusion in the foreground.

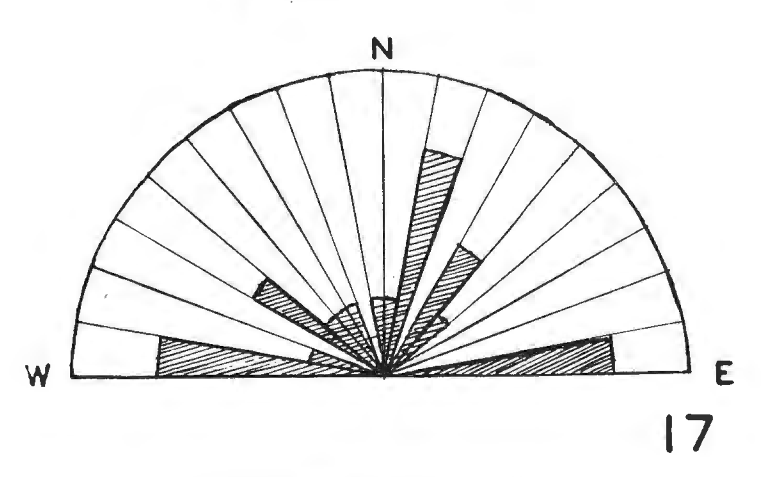


Fig. 17.— Strike diagram of jointing in the Aswan Area.

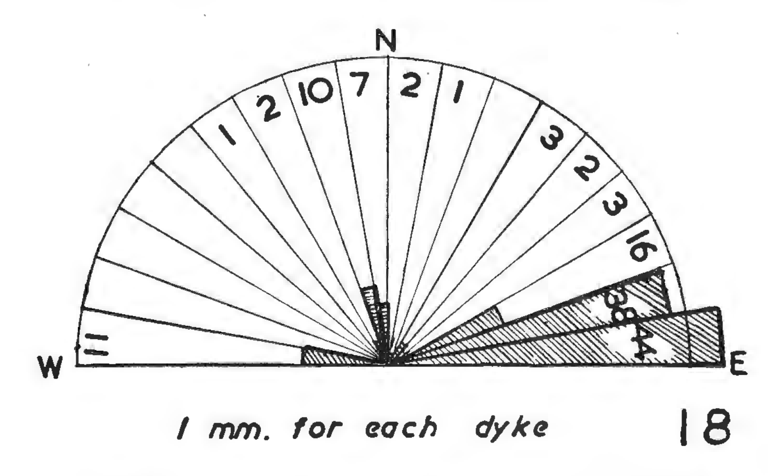


Fig. 18.— Strike diagram of late dyke intrusions; the actual number of dykes falling within each category is given.

Sur la Greffe cornéenne en Egypte

(expériences personnelles) (1)

par le Prof. Dr. Mohamed SOBHY

Mes confrères de notre honorable société savante, l'Institut d'Egypte, m'ont instamment demandé de prendre part à leurs communications scientifiques. J'ai hésité beaucoup d'acquiescer à leur désir, étant donné que les sujets médicaux sont trop techniques et pourraient ne pas les intéresser, puis lorsque ma décision fut prise je dus faire face à la dificulté du choix du sujet.

J'avais pensé à vous entretenir sur les tapis orientaux, un sujet qui fut soigneusement traité par feu le Docteur Aly Ibrahim Pacha, mais, vu les controverses parmi le public égyptien sur les greffes cornéennes, je me suis donné le courage d'adopter ce sujet dans le but d'éclairer le monde non-médical. Ce qui m'a incité aussi à adopter ce sujet fut la demande dernièrement d'une jeune dame bien cultivée, qui amène sa mère à ma clinique, que je remplace l'œil de sa mère qui était atteint d'une maladie rétinienne, par un autre œil enlevé à un cadavre. Cette demande m'amusa et j'ai naturellement dû expliquer à cette dame que c'est seulement la cornée qu'on transplante à la place d'une autre opaque, et j'ai ajouté que pour arriver à un bon résultat visuel ou optique par cette transplantation il faut que l'organe récepteur de l'œil, ou récepteurs sensoriels (nerf optique, rétine, etc.) soient normaux ou presque. J'ajoute ici que parfois on a recours à cette opération dans un but purement esthétique sans penser à améliorer la vue, et ce pour enrayer une tache ou une opacité cornéenne dans un œil même aveugle.

La greffe cornéenne, ou kératoplastie en grec, est un nom admis pour désigner l'opération du remplacement ou transplantation de tout ou d'une partie d'une cornée opacifiée par un fragment d'une cornée transparente.

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(1) Communication présentée en séance du 2 Mai 1955.

L'œil est comparé à une chambre noire ou à l'appareil photographique dont le fonctionnement est donné dans les cours de physique en traitant le chapitre de la lumière. Les rayons traversent le trou de la chambre noire, convergent et donnent une image reelle renversée de l'objet. Pour la mise au point des objets, l'appareil photographique est muni d'une lentille convergente ou objectif. Pour l'œil cet objectif, ou système optique, n'est rien que la cornée, d'une part, et le cristallin, d'une autre part. L'objet du cristallin est de renforcer le pouvoir optique de la cornée.

Toute opacité de la cornée ou du cristallin entraverait l'entrée des rayons lumineux à l'intérieur de l'œil à travers la pupille et ainsi brouillerait l'image des objets. L'opacité du cristallin, qu'on appelle cataracte, est enlevée par l'extraction. Cette opération de l'extraction de la cataracte fut faite de tous temps, même par les arabes et les hindous. Par contre, l'opacité cornéenne, qui n'est qu'un vestige cicatriciel des différentes maladies de cette membrane transparente — la cornée — a défié le bistouri du chirurgien. Toute tentative d'ablation de ces cicatrices fut suivie par d'autres cicatrices, et tous les efforts ont échoué et les taches cornéennes sont restées opaques après leur ablation. D'abord on pensa à des prothèses transparentes. Nussbaum, en 1856, est le premier qui put maintenir en place chez un lapin des petites plaques en verre pour plus de trois ans. Heusser, chez une jeune fille de 19 ans atteinte d'opacités cornéennes, implanta avec succès, en 1859, un petit cristal dans sa cornée opaque. D'autres ont remplacé la cornée humaine par la cornée des animaux qui ne tarda pas à s'opacifier à son tour, (greffes hétérogènes ou hétéroplastie). Les premières tentatives sur l'homme semblent remonter à Sellerbeck, le premier qui transplanta avec succès la cornée d'un fœtus sur celle de l'homme. Von Hippel fut le pionnier de la kératoplastie, (homoplastie) — homme sur homme — en 1887. Fox et Smith ont eu des résultats encourageants. Fuchs, de Vienne, (1894) — chez qui je passai une partie de ma jeunesse (1911-12) — entreprit des tentatives avec des résultats variables mais peu encourageantes. Son élève, Elschnig, de Prague, devint (en 1914) le deuxième pionnier de la kératoplastie après Von Hippel. Magitot (de l'hôpital Lariboisière de Paris) trancha dans ses rapports (1911-1916) la question de l'homoplastie. Filatov, Odessa, en 1924, fut le premier à adopter sur une grande échelle le prélèvement de la cornée claire chez le cadavre et c'est lui qui fit usage de la thérapie tissulaire d'après les constatations cliniques observées par Desmarres que le greffon transplanté aide à la clarification des opacités cornéennes autour de ce greffon. Après ça, les rapports se multiplient partout et parviennent du monde entier.

Donneur — celui-ci ne doit pas être porteur de maladies contagieuses, comme la syphilis, ou de maladies infectieuses, comme le typhus ou la fièvre puerpérale. Un des drames les plus touchants à ce propos est le suivant qui s'est passé en France: un des ministres du Gouvernement de Vichy, qui soi-disant collaborait avec les Allemands, fut jugé et avant son exécution conseilla à la compagnie qui devait le fusiller de tirer juste au cœur et épargner sa tête comme il avait fait don de ses yeux à un service ophtalmologique. Un autre drame qui n'est pas moins touchant est le cas d'un père qui amena son fils de Kenya et qui me supplia de greffer un de ses yeux à la place de l'œil malade de son fils. J'ai fait comprendre à ce père que les morgues au Caire sont pleines de cas d'accidents qui n'ont plus besoin de leurs précieuses prunelles. Seulement, d'après la loi, on ne doit pas s'acquérir des yeux que deux heures après la mort dont la réalité doit être assurée par deux médecins, et c'est pour cela que j'ai demandé aux infirmiers de bander les yeux des décédés après y avoir instillé des gouttes antiséptiques — pénicilline ou argyrol.

Receveur — celui-ci doit garder l'hôpital à la merci d'un donneur, puisque nous n'avons pas en Egypte une banque d'yeux. En attendant, il doit être soigné de tout foyer septique. Les paupières de l'œil du récepteur doivent être exemptes de microbes.

Opération: (1) L'énucléation de l'œil chez le donneur doit être faite d'une manière aseptique comme avec un être vivant. L'œil énucléé du donneur doit être gardé dans un bocal stérilisé entouré de glace ou gardé immédiatement dans la glacière à une température de 2°-4° jusqu'au moment de l'opération.

(2) Avant le prélèvement du greffon, l'œil du donneur est lavé à une solution d'antibiotique — pénicilline, auréomycine, etc... Le greffon est taillé à la forme d'une rondelle par un trépan d'un diamètre calculé à l'avance, ou à la forme d'un carré par un bistouri à double lame. Le diamètre du greffon varie suivant le cas — le greffon occupant toute la cornée pour la kératoplastie totale, ou une partie de la cornée dans les kératoplasties partielles. Chacun des deux genres de la kératoplastie a ses indications cliniques. Par le même trépan une partie de la cornée du récepteur est prélevée et remplacée par le greffon déjà préparé. La contention du greffon est exécutée par plusieurs manières, ou bien, comme à l'ancienne école,

par un lambeau conjonctival renversé taillé assez large pour couvrir la cornée, ou bien par des points de suture de différentes formes exécutés par des aiguilles spéciales montées d'un matériel spécialement fabriqué (soie fine de Lyon, etc.).

L'opéré doit garder le lit pour deux semaines, bandage binoculaire, repos absolu de la tête, ablation des fils de contention après une semaine du jour de l'opération.

Le greffon se trouble pendant les deux premières semaines puis commence lentement à s'éclaircir, et c'est en ce moment que les vaissaux sanguins commencent à envahir la cornée et s'arrêtent au bord du transplat. C'est un moment critique pour la survie du greffon. Si les capillaires de ces vaissaux empiètent sur le terrain du transplat, la vie de celui-ci est en jeu et son irradation aux rayons-X, radium ou strontium, aidée par la cortisone en injections, gouttes ou pommade, pourrait sauver la situation. Sinon, le greffon s'opacifie et le résultat, du point de vue optique est nulle. Il ne faut pas désespérer parcequ' une deuxième ou troisième opération pourrait avoir un meilleur résultat que le premier et être couronnée de succès.

La maladie du greffon dont je viens de parler pourrait frapper le transplat à n'importe quelle période après l'opération, mais si 9 mois passent sans complications la possibilité d'avoir à faire face à cette maladie est écartée.

La science n'a pas encore dit son dernier mot sur ce sujet.

STRUCTURE AND REPRODUCTION
OF ZYGOPHYLLUM ALBUM L. (1)

BY

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1.—*Morphological Features*

Zygophyllum album L. is a minutely papillose, pubescent or hoary decumbent, irregularly branching chamaephyte. The branches often as thick as goose quill.

Leaves are diphyllous fleshy, leaflets oblanceolate to obovoid or ellipscidal obtuse 4-8 m.m. long on a thick fleshy petiole of 5-15 m.m. Peduncle 2-5 m.m. long.

Flowers are solitary axillary, hypogynous, regular and hermaphrodite.

Sepals usually five green, rarely four, free imbricate, obovate-elleptical slightly concave or cucullate above.

Petals as many as sepals, free imbricate, white, with roundish slightly toothed lamina contracted into short claw.

Stamens twice as many as petals inserted at the base of the disc, obdiplostemonous, filaments filiform with a ligular appendages at the base which is entire or denticulate, anthers two celled open by longitudenal slits, pollen grains are whitish yellow and dusty.

(1) Communication présentée en séance du 4 avril 1955.

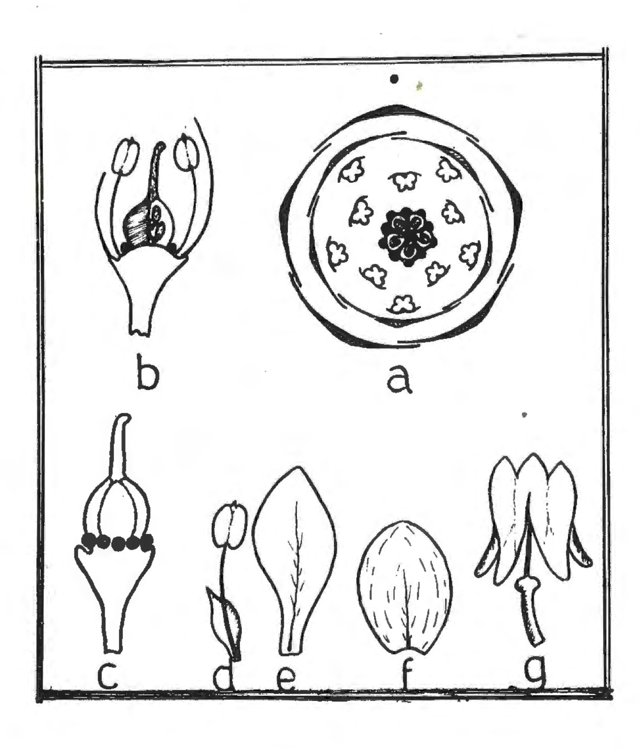


Fig. (1)

Flower and Fruit of *Zygophyllum album.*

a. Floral diagram.
b. Vertical section.
c. Ovary with nectary glands.
d. Stamen with ligular appendage.
e. Petal.
f. Sepal.
g. Mature fruit

Ovary sessile, five angled, rarely four, narrowed at the top into an angular style, (5) or (4) carpels, each carpel is one loculed and in each locule there are two or more superposed ascending ovules with a ventral raphe on axile placentation. Fig. (i).

Pollination is either self or cros by insects : *Leposcelis divinatorius* L. were seen visiting the flowers in the flowering period. There are ten nectary glands surroundnig the ovary base, which are among the contrivances which lead to cross pollination by insects.

Fruit capsule with usually five angles rarely four obcordate or turbinate-spherical 5-6 m.m. in length. Dehiscence of the capsule takes place from below upwards forming an umbrella shaped structure. One or two seeds present in each locule attain maturity. In very few cases three ovules attain maturity.

The seeds are rather heavy, not carried far on dispersal. They accumulate in large numbers in the vicinity and beneath the plant from which they have been produced. Albumen is scanty; testa becomes mucilaginous when wetted. Embryo is as long as seed. Germination is epigeal.

Flowering period extends from March to June and is much affected by the climatic as well as the edaphic factors which have their effect on accelerating or retarding the time of flowering. Plants growing in moist habitat retard in flowering as well as fruiting, while those of dry habitat accelerate in flowering and in many spots where there are severe dryness, the plants fail to produce flowers and fruits at all.

II.—*Anatomical Features*

(*a*) *Stem* :

A Transverse section of stem - Fig. (2) - shows that the cortex is relatively wide being differentiated into two or three layers of chlorenchyma below the epidermis and a wide area of thin walled parenchymatous cells in which a number of sclerotic patches are found. Pericycle contains well defined isolated strands of fibres. The epidermis is covered with a relatively thick layer of cuticle. The stomata

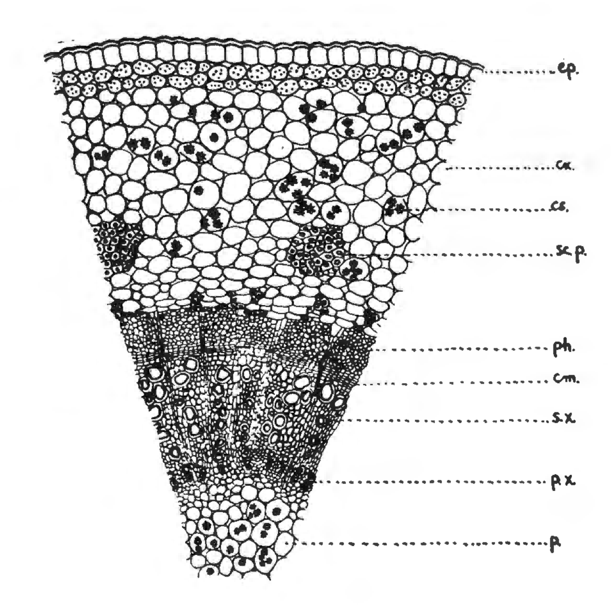


Fig. (2)

T.S. in Old Stem of *Zygophyllum album* x 250

cm.	: cambium.	cs.	: crystals of calcium oxalate.
cx.	: cortex.	ep.	: epidermis.
p.	: pith	ph.	: phloem.
p.x.	: primary xylem.	sc.p.	: scelrotic patch.
s.x.	: secondary xylem.		

are scattered irregularly amongst the epidermal cells. They have no subsidiary cells, a feature which is considered to be a characteristic feature in *Zygophyllaceae*.

Young stem is covered by simple unicellular hairs. Xylem and phloem form a closed cylinder in the young stem. The pith is com posed of thin walled tissue serving the purpose of water storage.

Cork arises in the inner most layer of the cortex. Crystals of calcium oxalate are widely scattered either solitary or in clusters.

(*b*) *Root* :

It is diarch. In old root, the primary xylem is embedded in very small thin walled parenchymatous cells. Calcium oxalate crystals are also common. Fig. (3).

(*c*) *Petiole* :

The vascular system of the petiole is formed of a central vascular strand, two subsidiary strands in latero-superior position and a ring of bundles; Fig. (4). Below the epidermis there are about three or more layers of palisade cells. The lowermost cells of mesophyll consist of large, thin walled water storage cells. Crystals of calcium oxalate are also present and usually in clusters. The stomata have no subsidiary cells and they are of Ranunculous type.

(*d*) *Leaflet* :

Leaflet is more or less similar to the petiole structure, but the two lateral vascular strands of the petiole are absent and the central vascular strand is relatively small.

With regard to the frequency of the stomata, it was found that in case of petioles or leaflets of *Zygophyllum album*, it is relatively very low. The mean number of stomata is thirty per one millimeter square.

III. — *Weights and Dimensions of Fruits and Seeds*

The different environmental factors affect the production,

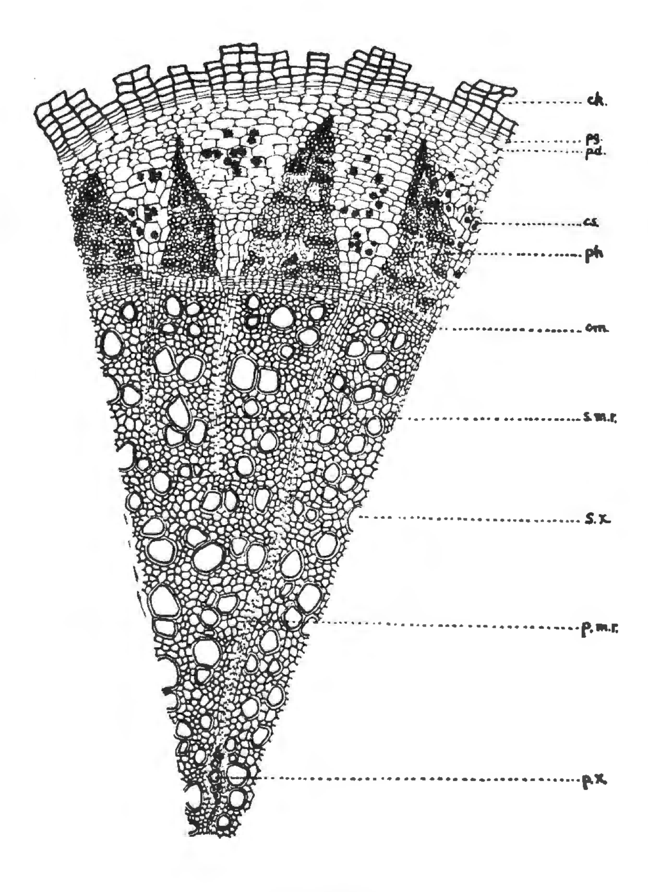


FIG. (3)

T.S. in Old Root of *Zygophyllum album* x 250.

ck.	: cork.	cm.	: cambium.
cs.	: crystals of calcium oxalate	pg.	: phellogen.
pd.	: phelloderm.	p.m.r.	: priminary medullary ray.
ph.	: phloem.	s.m.r.	: secondary medullary ray.
p.x.	: primary xylem.	s.x.	: secondry xylem.

weights and size of fruits and seeds. Among the most important environmental factors is the soil water content.

Fruits and seeds of *Z. album* were collected from five different spots of different localities and various measurements were carried out using micrometer screw gauge and a sensetive balance. Batches of fifty fruits or seeds were measured and the mean was calculated. Also the average number of fruits per plant and the average number of seeds per fruit were determined for each spot. In table (1) such average weights, dimensions and numbers are given.

The average weight of a fruit collected from different spots varied between 38.20 m.gm. and 15.33 m.gm. The maximum weight met with being 52.00 m.gm. while the minimum was 7.0 m.gm.

The average length of a fruit varied between 4.16 and 6.75 m.m. The maximum being 8.65 m.m. and the minimum was 3.20 m.m.

The average breadth of a fruit ranged between 3.70 and 5.20m.m. The maximum being 4.48 m.m. and the minimum was 3.12 m.m.

The average number of fruits per plant varied between 65 and 1500. The maximum number of fruits per plant met with being 4500.

The average weight of *Z.album* seed ranged between 1.03 and 0.54 m.gm. The maximum being 1.2 m.gm. and the minimum was 0.2 m.gm.

The average length of a seed varied between 2.26 m.m. and 1.85 m.m. with a maximum of 2.59 m.m. and a mimum of 1.55 m.m.

The average breadth of a seed ranged between 0.55 m.m. and 0.73 with a maximum value of 0.84 m.m. and a minimum value of 0.45m.m.

The average number of seeds per fruit varied between three and eight. The maximum number of seeds per fruit met with was fifteen.

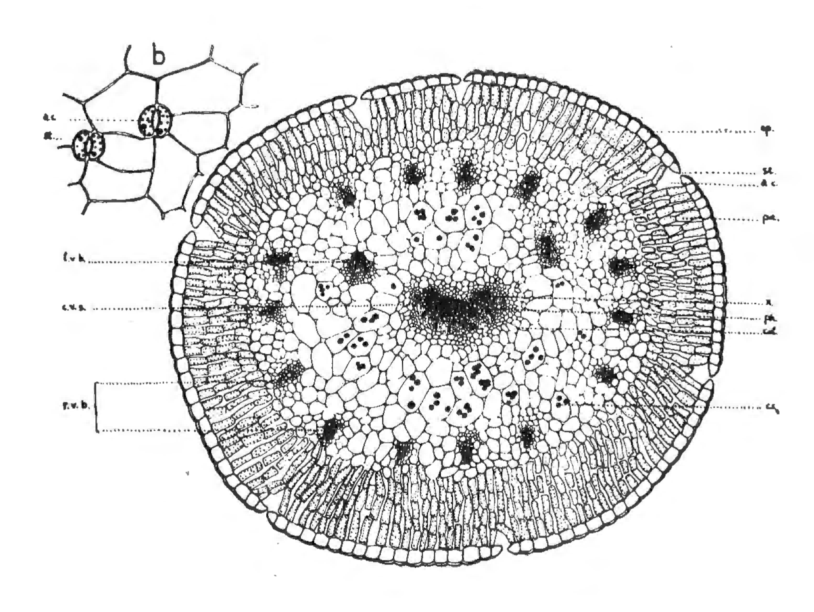


Fig. (4)

a.—T.S. in *Zygophyllum album* Petiole x 63.

b.—A Strip of epidermis of *Z. album* leaf.

a.c.	: air cavity.	col.	: collenchyma.
cs.	: crystals of calcium oxalate	ep.	: epidsmis.
c.v.s.	: central vascular strand.	pa.	: palisade cells.
l.v.b.	: lateral vascular bundle	r.v.b.	: ring of vasular bundles
ph.	: phloem.	x.	: xylem.
st.	: stomata.		

Table (1)

Average Weights and Dimensions of Fruits and Seeds

Spot No.	Water content % d.w.t.	Fruits				Seeds			
		Average weight m.gm.	Average length m.m.	Average breadth m. m.	Average number perplant	Average weight m.gm.	Average length m.m.	Average breadth m.m.	Average number per fruit
1	2.06	15.33	4.24	3.70	65	0.54	1.98	0.56	4
2	3.58	18.20	5.07	4.00	190	0.76	2.03	0.61	4
3	3.23	17.24	4.16	3.79	70	0.59	1.85	0.55	3
4	9.53	38.20	6.75	5.20	1500	1.03	2.26	0.73	8
5	8.32	29.88	5.92	4.61	550	1.00	2.12	0.68	7

IV.—*Seedling*

On germinating the seeds of *Zygophyllum album*, the radicle emerges out tearing the testa at the tapering end of the seed and the hypocotyl elongates forming a loop which straightens gradually carrying the plumule and the two cotyledons above the soil surface. The ruptured testa falls and the two cotyledons form two green fleshy leaves between which the plumule is present. Fig. (5).

V.—*Effect of Depth of Sowing on Germination*

Six sets of equal sized pots were filled with homogenous soil formed of a mixture of sand and silt (1:1) after being sifted with a sieve to remove gravels and stones. In each pot 25 seeds of *Z. album* were sown at different depths. In the first set, seeds were sown superficially being only covered with a thin layer of soil. In the other sets, seeds were sown at depth of 1/2, 1, 2, 3 and 4 cm respectively. Equal amounts of water were added to all pots at equal intervals. Percentage of germination was recorded daily; Table (2). All seeds were collected from one locality at the same date (Helwan New Spring, June 1952).

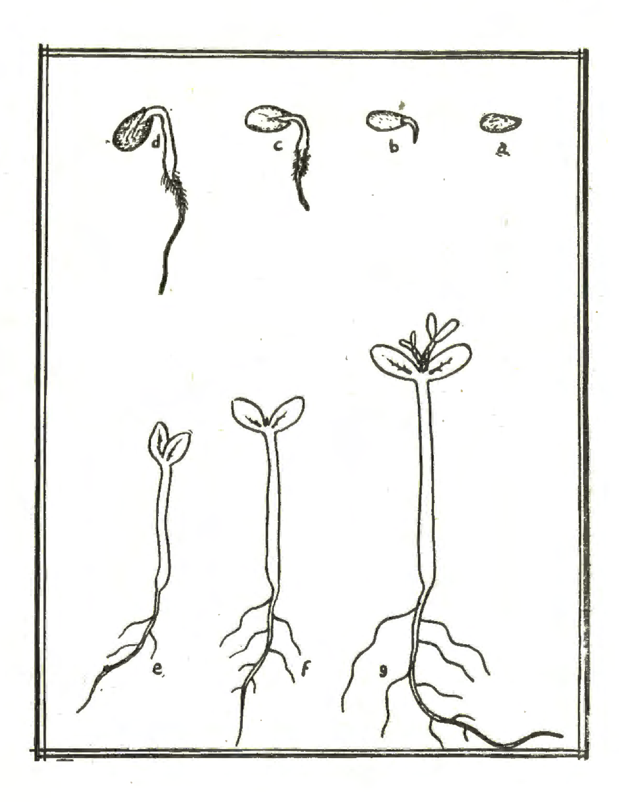


Fig. (5)

Seedling of *Zygophyllum album* at auccessive stages of development

The highest percentage of germination of 56% was obtained when seeds were sown at a depth of 1/2 cm. At a depth of 1 cm. it fell to 36% and at a depth of 2 cm. it fell to 21%. At a depth of 3 cm. only 3% succeeded to germinate, while at a depth of 4 cm. no seedling appeared at all. Only 6% of seeds that were superficially sown succeeded to germinate.

The low percentage of germination in deep layers of soil may be attributed to weakness of plumule, being unable to penetrate such thick layers of soil before reaching light and air. While the low percentage of germination of seeds that were superficially sown may be due to the direct effect of sun, light or high temperature of soil surface.

Table (2)

Effect of Depth of Sowing on Germination

Depth of sowing	No. of seeds	3 days	4 days	5 days	6 days	7 days	8 days	9 days	10 days	11 days	13 days	Total %
Surface	100	—	3	2	1	—	—	—	—	—	—	6
1/2 cm.	100	—	—	24	17	15	—	—	—	—	—	56
1 ,,	100	—	—	—	12	16	4	4	—	—	—	36
2 ,,	100	—	—	—	2	6	7	5	—	—	—	21
3 ,,	100	—	—	—	—	—	—	2	1	—	—	3
4 ,,	100	—	—	—	—	—	—	—	—	—	—	0

N.B.—Time of experiment : June 1952.

VI.—*Seasonal Variation of Germination*

Seeds of *Zygophyllum album* were collected from one locality (Helwan New Spring) on 3-6-1952. One hundred seeds were sown every month, at 1/2 cm. depth, in pots filled wiht homogenous soil formed of a mixture of sand silt (1:1). Equal amounts of water were added to the pots at equal intervals. Seedlings which appeared above soil surface were recorded daily and the total number of seedlings as well as the percentage of the survival seedlings were recorded and the results are tabulated. The result is presented graphically in Fig. (6).

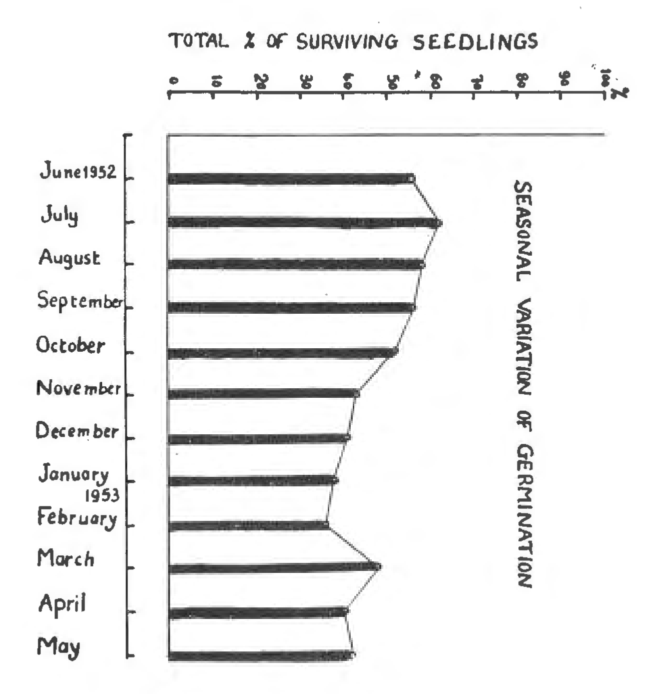


FIG. (6)

Seasonal Variation of Germination.

From table (3), we notice :

1. The number of surviving seedlings during summer is relatively higher than that during winter, reaching its maximum of 62% in July 1952 and its minimum of 36% in winter, February 1953.

2. Seeds took very long time to germinate during winter. In December 1952, the first seedlings appeared after twelve days. In summer, seeds took shorter time, in July 1952 seedlings began to appear above soil surface after four days only.

The marked difference in the percentage of germination as well as in time taken for germination is due mainly to the difference in temperature.

Table (3)

Seasonal Variation of Germination

Time of sowing	No. of seeds	Number of Seedlings appearing above soil surface														Tot. % of surviving seeding
		4 days	5 days	6 days	7 days	8 days	9 days	10 days	11 days	12 days	13 days	14 days	15 days	16 days	17 days	
1952																
June	100	—	24	17	15	—	—	—	—	—	—	—	—	—	—	56
July	100	22	19	10	11	—	—	—	—	—	—	—	—	—	—	62
Aug.	100	—	25	23	6	4	—	—	—	—	—	—	—	—	—	58
Sept.	100	—	26	17	7	4	2	—	—	—	—	—	—	—	—	56
Oct.	100	—	—	27	12	6	2	4	1	—	—	—	—	—	—	52
Nov.	100	—	—	—	—	—	28	8	3	1	3	—	—	—	—	43
Dec.	100	—	—	—	—	—	—	—	—	—	20	9	9	2	1	41
1953																
Jan.	100	—	—	—	—	—	—	16	4	8	6	4	—	—	—	38
Feb.	100	—	—	—	—	—	14	4	4	6	8	—	—	—	—	36
Mar.	100	—	—	—	—	—	12	6	16	8	6	—	—	—	—	48
Apr.	100	—	—	—	—	10	2	12	6	6	4	—	—	—	—	40
May	100	—	—	8	10	10	6	8	—	—	—	—	—	—	—	42

SUMMARY

(1) *Zygophyllum album* L. is a mintely papillose, pubescent or hoary decumbent irregularly branching chamaephyte; leaves dipphyllous fleshy; flowers solitary axillary, hypogynous, actinomorphic, hermaphrodite; fruit capsule usually with five angles; it dehisces from below upwards.

(2) Anatomical study of *Z. album* shows the presence of crystals of calcium oxalate either solitary or in clusters in all organs; root diarch; stomata with no subsidiary cells; epidermis being covered with relatively thick cuticle; petiole with a central vascular strand, two subsidiary strands in latero-superior position and a ring of vascular bundles; presence of large thin walled storage cells in petioles, leaflets and pith of young shoots; leaves with low stomatal frequency.

(3) Fruit consists of five locules, each usually with two seeds; germination of seeds being epigeal. Successful germination was obtained when seeds were sown at 1/2 cm. depth. Highest percentage of germination occurs in summer months.

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Egyptian Influence in the Sculpture of the United States [1]

BY

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Due to the unique physiographic character of Egypt it is comparatively less difficult to measure the effects of European art actions on the cultural conduit of the Nile Valley, than it is to collect and evaluate Egyptian idioms which have infiltrated the studios and galleries of Europe and America. Stylistic revivals in the plastic arts seem to endorse a pretense on the part of society to disinherit the recent past and to emulate ideal forms of the more remote past. But in spite of the forces propelling it, the legitimacy of artistic revivalism is never above question.

It has been within the author's experience to hear artistically sensitive Egyptians condemn the architectural design of the mausoleum for Saad Zaghloul Pasha, and to denounce this structure as a superficial, reactionary expression epitomizing a typical pattern of post-Pharaonic revivalism. It is, of course, a truism that there is much to arouse the suspicion of a contemporary in the unqualified resurrection of ancient artistic orders that were nourished by concepts and beliefs different from those held today. Yet the architectural tribute to Saad Zaghloul embraces some very real and measurable qualities of nostalgia and sentimental heritage, both of which every country of ancient civilization is entitled to engender.

Certainly my Egyptian colleagues who were so critical of Pharaonic resumptions in the architecture of their own country would be

stunned by encountering on the American scene public buildings, cinemas and mausolea masquerading behind Pharaonic façades, all these and others garnished by sculptured sphinxes and winged disks. Even more startling to behold would be a "Ptolemaic temple" located in Southern Oregon (the exterior is decorated with incised reliefs depicting ancient deities) which, on closer inspection, reveals its original and continued function to be that of an automobile garage. To be certain, this isolated example is both ludicrous and bizarre, however, its very existence on the American scene reflects a fascination long held by Americans for artistic notions identifiably Egyptian.

Indebted as is Western civilization to the cultural intelligence collected by Bonaparte's "special" battalion in Egypt, there is evidence to indicate that individual investigations were conducted, published and disseminated years before the Nile campaign. In 1769 there appeared in Rome a manual on style by Piranesi entitled, *Diverse maniere d'adornare i cammini*. This study supplied visual information on Egyptian sculptural detail, and copies eventually found their way into the studios of some of the enlightened and speculative architects of the period.

In the early years of the American Republic, British art and letters set a cultural precedent that continued for well over a century. It is interesting to note, however, that when a Committee was appointed by the Continental Congress to consider designs for the Great Seal of the United States, heraldic motifs originating in Europe were put aside in favor of more ancient symbols. On June, 20, 1782, the design elements for the Great Seal were adopted by the Congress. The obverse of the seal was dominated by an American eagle; the reverse side displayed a truncated pyramid rising out of a plain, with a range of mountains in the background(2). There were thirteen courses of stone in this pyramid, each symbolizing one of the original thirteen states. Framed in a triangle above the pyramid appeared the "eye of providence", the position of which was obviously intended to indicate spiritual over material values(3). Mr. Maverick has advised that the source of information on this *Uzat*, referred to when the design was under consideration by the committee, was *The Elements of Heraldry* by Mark Anthony Porny. Throughout this book, which was published in London in 1765, "The Egyptian origin of heraldry was emphasized".(4).

It is to be noted that the Great Seal was not designed by artists but rather by gentlemen scholars who were conversant with ancient Egypt through writers of classical antiquity. These sources were indeed considered most reliable until Denon and Jomard drew aside the veil that had covered Egypt for centuries, thus revealing an even more mysterious countenance beneath. It will be recalled that the preliminary account "*Voyage dans la Basse et la Haute Egypte*", was published by Denon in Paris in 1802. And Denon, an artist who wielded both crayon and stylus with precision and sensitivity, was as responsible as any other for the flavor and the success of the remarkable "*Description de l'Egypte*" (1809-13).

The data therein contained exerted an early and steady influence on a host of continental artists and writers. One of the early experiments in the plastic arts was the Egyptian Hall, built in London during the years 1811-12. Pharaonic, or more correctly Ptolemaic, interpretations were relegated to the façade, over the portal of which were arranged two statues of Isis and Osiris, each surmounted on the second floor by two recumbent sphinxes.

From illustrations of the façade of the Egyptian Hall(5), one does not get a favorable impression of the statuary, nonetheless, it should be pointed out that it would have been virtually impossible to have found a competent sculptor who had real knowledge of Egyptian statuary, for professional sculptors were at that time engaged with other stylistic directives. But if England could not discover the sculptors who would be available for such a venture, the problem in the United States was more serious, for it would have been difficult to even find a native sculptor who had attained professional stature. Following the colonial period Yankee folk-sculptors rather excelled in the manufacture of useful objects of art, examples of which ship figure-heads, tombstone reliefs and weather-vanes are noteworthy. It is not surprising, therefore, that whatever services such artisans as stone carvers and plaster modelers might have rendered at the time, they were necessarily controlled by the more enlightened architect. The effect of this control was one of limiting the sculptor's architectural service to that of ornamental relief.

Professor Hamlin states that in the 1830, "Egyptian architecture in all its magnificent power was being presented to the America of

those days; book after book was being issued to show its glories" (6). Indeed the American Quarterly Review devoted 40 pages to Egyptian architectural character and, it should be added, much of this presentation was based upon material taken from the *Description de l'Egypte*. In rapid succession appeared a series of American monuments which clearly drew upon Pharaonic proportions (exterior) and many of these were enriched with sculptural relief.

The distinguished revivalist of Greek architecture in America, John Haviland of London and Philadelphia, was the author of the New York Halls of Justice (popularly known as the Tombs) which was an impressive one-storied pile based on ancient Egyptian prototypes (Plate I). Concurrently, in 1836, Haviland prescribed plans for the New Jersey State Prison in Trenton,(7) which appeared visually to be much the same in surface and spirit to both the "Tombs" and the Court House of Newark, New Jersey (1837). Other buildings erected, literally behind Egyptian façades, were the Railway Station at NewBedford, Mass., by John Avery Parker, and the gateway for the Old Grainery Burying Ground(8), located in Boston and designed by Isaiah Rodgers in 1840. In all of the buildings mentioned the sculptural treatment of the façade was invariably dominated by the *Horbehutet*(9), the winged disk, and punctuated with such devices as lotus and palmiform capitals, and occasionally a "royal" cartouche.

Nor was the Egyptian "craze" in architecture about to be exhausted. It carried over into the next two decades as exemplified in the exterior of the Virginia Medical College(10) at Richmond, erected in 1844-45, and in the gateway to the Hebrew Cemetery of Newport, Rhode Island, designed by Rodgers in 1855.

Turning to sculpture in the round produced in this early period there is but little to examine — at least with visual pleasure. "In 1816, it was taken for granted that no worthy native American sculptor could be found to execute a statue of George Washington for the state of North Carolina..."(11). Certainly artistic stars in the persons of Houdon of France and Canova of Italy had outshown all satellites of far lesser magnitude, especially those of the young American Republic.

It might be said that while the sensible American sought his fortune in the great Western exodus, the sensitive American went Eastward across the Atlantic to plunge, body and soul, into the cultural reservoirs of antiquity. Some did not return; others might better have not returned. Typical of American sculptors of the mid-nineteenth century was William W. Storey of Boston. His most accomplished work was a seated statue of "Cleopatra," carved in marble and first exhibited in London in 1862. Technically the statue is perfectly executed in the "white moonlight" of Carrara. The queen's costume was essentially Roman; only the accessories were Egyptian. The artist seems to have read all of Shakespeare's interpretation into this one work. It appears too literal to indicate any serious study of Egyptian statuary. Yet Nathaniel Hawthorn, an illustrious American literate of the day, saw fit to describe Storey's interpretation of the Ptolemaic Queen as "fierce, voluptuous,passionate tender, wicked, terrible, and full of poisonous and rapturous enchantment...."(12). After considering this statue, which was later acquired by the Metropolitan Museum, one wonders if Hawthorn rather imagined than perceived these capabilities in the work.

In the last third of the nineteenth century the artistic center of gravity in Europe shifted from Rome to Paris. And by this time a native school of sculpture was well established in the United States. Nevertheless, European internship was still a prerequisite for successful practitioners along the Eastern seaboard of the United States. From this period there are a few singular examples in which Egyptian inspiration can be detected. No exposition of this generation can be complete without mention of Frank E. Elwell. He was a native of Massachusetts and was trained at the Ecole des Beaux Arts of Paris under Falguière. At the Paris Salon of 1896 Elwell exhibited a large seated female figure entitled "*Egypt Awakening*" (Plate II). The statue was not a neo-greco-latin interpretation of an Egyptian subject — rather it is probably the first known instance of an American statue resulting from a sculptor's keen observation of Pharaonic statuary. Bilateral symmetry was injected throughout the composition and the decorative accessories were accurate and logically integrated. It is not quite clear whether the theme was intended to soliloquize the rise of modern Egypt or the rejunevation of ancient Egypt. Perhaps both were projected. Elwell's "Egypt" wore the headgear of the goddess Hathor, yet in countenance she appeared

to be less the *theotokos* of an ancient cult than a virgin priestess of a nineteenth century atelier. Despite its dated manner the statue remains a creditable example of the new-Pharaonic style.

During the same decade other Americans flirted with ancien motifs, among them Henry A. Lukerman and Charles Graftly are entitled mention. Of the latter, however, the critic-sculptor Lorado Taft has judiciously considered, "Mr. Graftly lost himself...in Egyptian mysticism, and the consequence is an Egyptian chimera."(13)

Ecclecticism, however, was not confined to the nineteenth century. New targets, since exploited by early twentieth century criticism, were set up in neo-Pharaonic style and used, often daringly but rarely in good taste, in designs for theaters, cemeteries, banks, and fraternal buildings.

Another Egyptionizing agency in art that operated somewhat apart from the speculations of official and commercial architecture and Salon sculpture, was Free Masonery. According to Heckelthron(14) "The lodges in the territory now forming the United States date back as far as 1729". Certainly the masonic affiliations of the early champions of the Republic exerted considerable influence on the art and architecture of the national capital.

Dr. Churchward has traced masonic legacy to ancient Egypt and summarized "...our Grand Order has originated from the sublime teachings of Ptah..." (15). The extent to which Free Masonery has drawn upon Egyptian symbols and devices can be readily perceived on entering the principal compartments of their temples. Egyptian art was further exploited by various spurious fraternal off-shoots which were even more conspicuous in their attempt to reinstate the ancient mysteries of the Nile(16).

A fair example of Egypto-Masonic ramification in sculpture can be observed in one of the two box-type statues situated on either side of the principal entrance of the façade of the masonic temple in Spokane, Washington (Plate III). More or less identical these two scribes were designed in 1924 by the architects of the building, Messrs. Riggs and Van Tyne. From the relief inscription on the apron of both cement figures one reads, in combined Latin and

hieroglyphic characters, *Senmut, Architect of Egypt*. The reader need only compare this interpretation with the Dynasty XVIII granite statue of Senmut(17) in the Cairo Museum, (Cat. No. 42114), which depicts the scribe as protector of the princess Nefru-Ra, to determine an inspirational source available in 1924. One can also see at a glance, the artistic deviation, in form and spirit in the Spokane Senmut, all attending no doubt to the difference in function, material and setting.

Howsoever the above example might be regarded today, it should be emphasized that it was given full license at the time it was dedicated, just thirty years ago. Another example of masonic statuary that appears considerably more competent in both workmanship and design is the "*Sphinx of Power*" by A.A. Weinman(18). The sculptor who was a distinguished fellow of the National Sculpture Society, executed this heroic interpretation of the great composite beast revered by the ancient Egyptians, for the Scottish Rite Temple of Washington, D.C. Weinman's sphinx was contemporaneous with that of Moukhtar's "*Réveil de l'Egypte*" (inaugurated in 1928) (19). Each complemented the other as it revealed the stylistic directives of its respective capitol. The Washington sphinx was carved of marble; it is traditional in the recumbent pose and is treated with neoclassical detail. Its counterpart in Cairo rears upward and literally out of tradition; its massive form conforms to the bold language of the granite out of which it was shaped, and the regeneration of modern Egypt which it was doubtless intended to symbolize.

The considerable interest shown toward all things Egyptian, especially those manifested in American art and architecture after 1925, can in large part be attributed to the discovery and excavation of the tomb of Tut-Ankh-Amon in 1923 (20). This event was given exceptional notice in the international press, and entertained the imagination of the American public during a prosperous and speculative decade. Prosperity also gave impetus to the art of sculpture, an art which traditionally thrives in a luxuriating society.

The masonic temple statues previously cited were produced in the wake of the captivating discovery in the Valley of the Kings. Egyptian tendencies during the decade of the thirties can best be be summarized by a look at the sculpture exhibited at the New York World's Fair of 1939.

Sylvia Shaw Judson, a sculptress working in Illinois, entered in to the exhibition a cast-stone statue entitled "Young Woman"(21). This columnar figure was clothed in a simple wrap-around skirt originating at the breasts and continuing down nearly to the ankles. The pose was symmetrical, feet were together and arms were crossed. The head, and more especially the face, conveyed some of the pleasant calm of female effigies dating from the Old Kingdom.

In the same exhibition two Californians submitted works that clearly demonstrated their personal ability to translate ancient lessons into contemporary forms. "Negro Woman"(22), by Mr. Sargent Johnson was executed in wood and then polychromed. Once again symmetry predominated in the composition while paint was applied in flat masses in order to promote the forms. In contrast to Johnson's massive treatment of the human figure was a small "Hawk"(23) by Robert B. Howard. This was worked in a decorative combination of redwood and copper. The bird was severely abstracted yet, in pose and in the easy flow of line, it was akin in form and spirit to the small statuettes of the Pharaonic god Sopt, the Horus of the East.

Another avenue of investigation that ultimately led sculptors to revaluate Egyptian art was African negro sculpture. Since the beginning of the twentieth century negro carving constituted the primary source of inspiration for the cubists. Theirs was a natural reaction against the academies of neo-Hellenism and romantic-realism. Abstraction and geometrization of human and animal forms became the order of action for expressionists as well as cubists, and only after many years of experimentation was it realized that ancient Egyptian sculpture was in complete possession of those attributes so much admired in the production of Central Africa. The obvious differences existed mainly in the fact that negro sculpure was less inhibited, while that of Egypt was more controlled.

A carving in wonderstone (Plate IV), executed by Marion Walton in 1939, suggests at least two sources of stylistic influence. The figures are compressed and the surfaces are finished in the terse vernacular of the primitive negro sculptor. Yet there is a gentle flow of line running through the composition that, in typical Egyptian manner, relieves the strict geometry of the abstracted parts. The coiffures are rendered in accordance with Pharaonic pattern while

the arms are stiffly draped from blocky shoulders, reminiscent of the hieratic pose. Mrs. Walton has written, "I often thought of sculpture as something that could be held, compact and comfortable, in the hollow of a giant hand, but built solid and strong like a building." (24) Without doubt such an attitude toward form would not have been alien to an artisan of Ptah.

Somewhat analogous to the statement of Mrs. Walton is another by the American sculptor Hugo Robus. Surveying the western tradition, to which he does not hesitate to pledge his allegiance, Robus has said, "We are taught the wonders of the Golden Age, but its classical stones are cold blooded if magnificent creations compared with the heartwarming sculpture which preceded them" (25). More specifically do those words bear testimony as we compare a sculpture by Robus, entitled :"Supplication" (Plate V), with tomb reliefs of Dynasties XVIII and XIX. In the lower register of a XVIIIth dynasty limestone relief (26) in the collection of the Berlin Museum, we can observe a funeral procession for a high priest of Memphis wherein two priests in the right hand corner are beseeching the gods to receive and protect the deceased. As was the custom, the heads of the priests are shaven. The musculature in their arms is smooth and supple, and their hands have been stylized into wispy, bird-like claws. The heads are thrown backward and the faces are most expressive. They are full of tension and seem to be in the act of speaking. All this gesticulation is more or less typical of depicted funerary processions in which the participants were engaged in various forms of petition for the de funct.

In "Supplication" we note what also appears to be a shaven head that has been detailed with a sensitive face wearing a rather trance-like expression. The features are nearly negroid. Considerable attention has been directed into the graceful exchange of line between the fingers and the lips. To be certain it is a contemporary sculpture, yet, there are qualities in the shapes, the forms, the posture, and in the general surface treatment sufficient to indicate that in this work Robus is more endebted to ancient Egyptian than any other source.

By whatever means contemporary American sculptors have regarded the silent secrets embedded in Egyptian works, it appears

quite obvious to me that above elegance of form and surface treatment there exists great respect for fine craftsmanship in connection with enduring materials. This observation particularly applies to the modern school of direct carving for its underlying philosophy rests firmly upon the belief that a kind of communion is enacted between the sculptor and the stone. In the stone carvings of bird-forms by Cleo Hartwig(27) and cat-forms by William Zorach(28) one feels the fusion of both subject and material. These have been veiled in a mystical film that seems to convert the obdurate stone into genial poetry.

To the native schools of our period should be added two European sculptors who, in recent years, have emigrated to this country and exerted considerable influence on American art. Alexander Archipenko is often credited for his fusion of Hellenism with the abstract dictates of modernism. However, he is an enthusiastic admirer of Egyptian art and has thoroughly investigated the aesthetic possibilities of polychromy. In the sculpture of Jacques Lipshitz one seems to be in the presence of beings which have been subjugated to the "abstraction of nature and natural forces." His "Mother and Child" (Plate VI) is an elemental thing — it is full of misery, of dissonance, of protest. It screams in convulsive waves against the barbaric and inhuman treatment men have invented for their fellowmen. This is modern primitivism. Yet if we turn from official Pharaonic art to that of the ancient popular vernacular a remarkable affinity will be discerned with the sculpture of Lipshitz. From the predynastic through the Coptic periods popular exvotos of a Mother goddess were manufactured, and these often were combined with zoomorphic devices which were calculated to render a double service to the immortalized myths of fertility and creation. This is exemplified in a small terra-cotta figurine (Plate VII) of a deity seated upon a birth brick: the design of the upraised arms suggests the horns of a cow, sacred to the goddess Hathor, and the triad formed by the breasts and the abdomen suggests the face of an animal.

In review, the predominating evidence indicating Egyptian influence in American sculpture appears to have been, in great measure, a variation on the imitative, the symbolic, and the technical. In the architectural sculpture of the nineteenth century, neo-Hellenism was simply displaced by neo-Egyptianism. The spirit of revival in both

was essentially the same. In the "Egypt Awakening" of Elwell we have noted compositional and symbolical paraphernalia, the combination of which demonstrates the propensity on the part of both artist and society for literal and somewhat prosaic statement in sculpture. In the box-type adaptation of "Senmut" we have recognized an ancient form which has been insensitively interpolated in cement. Furthermore the impression is given that the statue is less a statue than an accessory commissioned primarily as a kind of three-dimensional insignia.

Of the sculpture illustrated only Walton's "Young People" has been carved directly out of a block of stone. Although the nature of the forms endorses the nature of the material, textural variations and surface treatment further indicate an appreciation of lessons learned from ancient Egyptian works. In contrast, the Robus statue was modeled for casting in bronze and was clearly intended to be an emotive statement. Like the "Mother and Child" of Lipshitz it is an attempt to convey a spiritual message. More than the other works cited, these two sculptures exemplify the revolt of the contemporary American artist against the mimetic formulae of the ancient Greeks.

Whatever the merits and demerits of seeking inspiration for contemporary statement from the art of the past, orientation toward Egypt has existed in the sculpture of the United States for well over a century. This production is illustrated in much sculpture that shows affectation and an irrepressible urge to emulate the past. But in recent years American sculptors have exhibited through their work a determined effort to investigate ancient Egyptian art, not for surface suggestion but for insight into the qualities that make the language of form both universal and timeless.

NOTES

(1) Communication présentée par Mr. le Dr. Alexandre Badawy. en séance du 14 mars 1955.

(2) Although the die for the reverse of the Great Seal has never been cut, the design remains very much as it was originally drawn by Wm. Barton in 1784. Subsequently, designers commissioned to rework the reverse, paid particular attention to reproduce "the scale of the great pyramid." Official seals, it is true, are generally classified under numismatics, nevertheless, the Great Seal, as a problem in bas-relief, quite logically come within the province of the sculptor as well as the engraver.

(3) Department of State, *The History of the Great Seal of the United States*, Washington, D.C., 1909. Several illustrations of proposed seals appear in this study.

(4) Maverick, M., *The Great Seal of the United States*, Egypt, Spring issue, 1952.

(5) Honour, H., *Curiosities of the Egyptian Hall*, Country Life, Jan. 7, 1954, ill. p. 38.

(6) Hamlin, T., *Greek Revival Architecture in America*, Oxford, New York, 1944, p. 331.

(7) Roos, F.J., *The Egyptian Style*, Magazine of Art, vol. 33, No. 4, ill. fig 3, p. 219.

(8) ibid., ill. fig. 11, p. 223.

(9) ibid., ill. fig. 7, p. 221.

(10) ibid,. ill., fig. 5, p. 220.

(11) Gardner, A.T.E.., *Yankee Stonecutters*, Metropolitan Museum of Art, 1945, p. 3.

(31) Hawthorn, N., *The Marble Faun*, chapt. xiv.

(13) Taft, L., *The History of American Sculpture*, New York, 1924, p. 511, figs. 96, 97.

(14) Heckelthorn, C.W., *The Secret Societies of All Ages and Countries*, London, 1879, vol. II, p. 99.

(15) Churchward, A., *The Symbols and Signs of Primordial Man*, London, 1913, p. 8.

(16) Of these the rites of MISRAIM, established in 1814, and of MEMPHIS, founded in Paris in 1839, were obvious attempts toward reinstitution.

(17) Aldred, C., *New Kingdom Art in Ancient Egypt*, London, 1937, ill. Pl. 30.

(18) National Sculpture Society, *Contemporary American Sculpture*, New York, 1929, ill. p. 330.

(19) Ghazi, B.A., and Boctor, G., *Moukhtar ou le Réveil de l'Egypte*, Cairo, 1949, ill. facing p. 49.

(20) Of recent date the excavation of a royal tomb chamber at Saqqarah and the discovery of a solar barque at Giza, have detonated another revival of the Egyptian "craze" in American fashion.

(21) *American Art Today*, National Art Society, 1939, ill. No. 669.

(22) ibid., ill. No. 668.

(23) ibid., ill. No. 660.

(24) Walton, M., *A Sculptor Looks Ahead*, Magazine of Art. vol. 33, No. 7, p. 422.

(25) Robus, H., *The Sculptor as Self Critics*, Magazine of Art, vol. 36, No. 3, p. 98.

(26) Ranke, H., *The Art of Ancient Egypt*, Vienna, 1936, pl. 230.

(27) Brumme, C.L., *Contemporary American Sculpture*, New York, 1948, ill. pl. 60.

(28) Wingert, P.S., *The Sculpture of William Zorach*, New York 1938, ills. Plates 42, 44.

ILLUSTRATIONS

I. *Halls of Justice*, New York, from an engraving of the Eno Collection of the New York Public Library.

II. *Egypt Awakening*, by Frank Elwell, plaster original, private collection, Parsi.

III. *Senmut*, Riggs and Van Tyne, architects, cement, Masonic Temple, Spokane, Wash.

V. *Group of Young People*, by Marion Walton, African wonder-stone,

V. *Supplication*, by Hugo Robus, plaster for bronze, courtesy Grand Central Galleries.

VI. *Mother and Child*, by Jacques Lipshitz, bronze, coll. Museum of Modern Art, New York, photo., courtesy Buchholz Galleries.

VII. *Votive Figurine*, Egypto-Roman, terracotta, coll. author, photo., C. Brumbaugh.

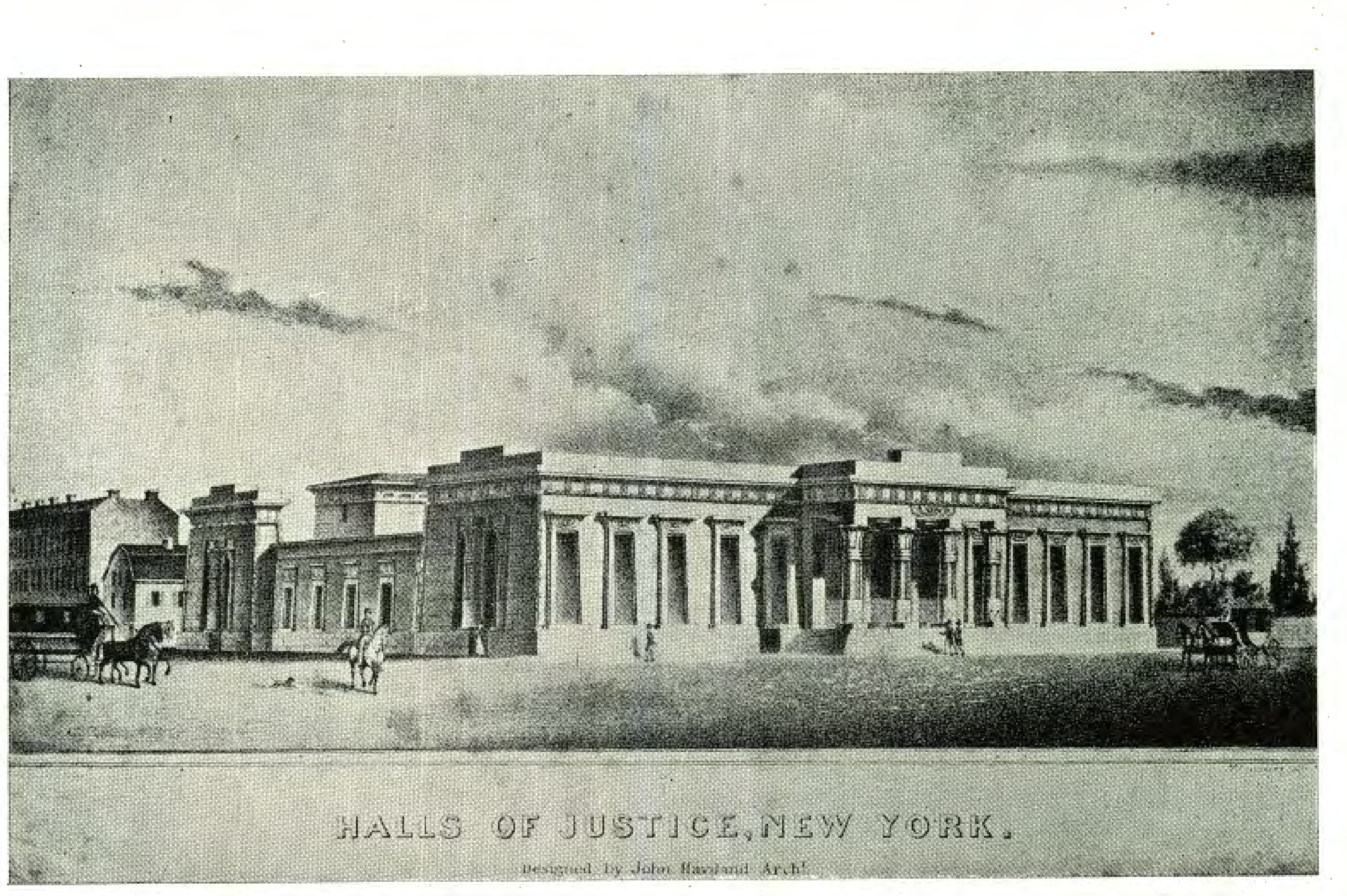


Fig. I



Fig. II

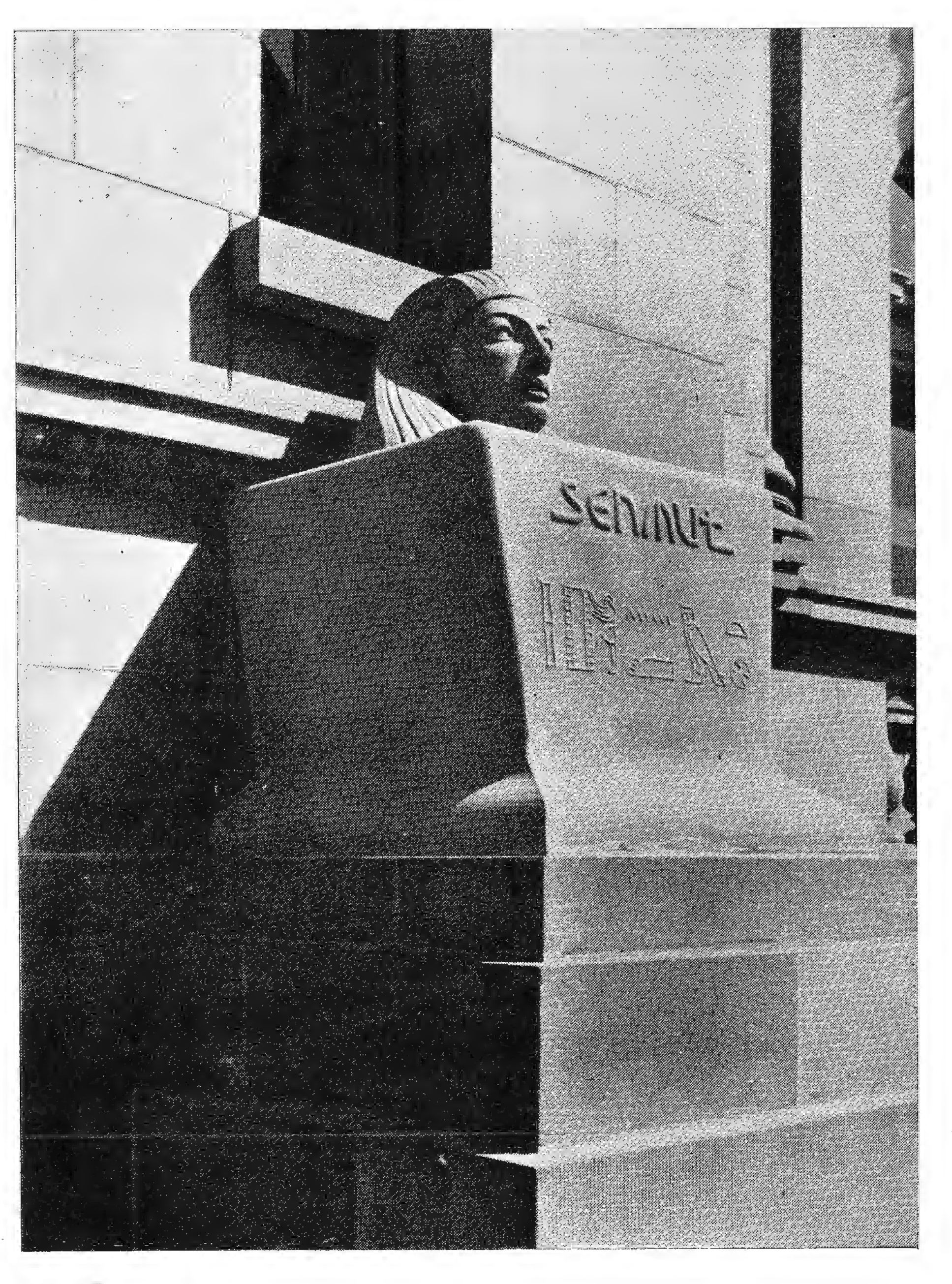


Fig. III



Fig. IV



Fig. V



Fig. VI



Fi. VII

Projets de Barrages-Réservoirs en Egypte, au XIXe Siecle [1]

PAR

Jean-Edouard GOBY

A cette même tribune, l'Ingénieur Julien Barois notait : "Il n'existe peut-être pas un autre grand fleuve aussi bien étudié que le Nil dans tout ce qui concerne l'emploi de ses eaux pour l'agriculture[2]". C'était en 1904. Depuis lors, des observations et des recherches sans nombre ont été faites : chimistes, géologues, ingénieurs, physiciens, voire même littérateurs se sont penchés sur toutes les questions relatives à l'artère de l'Egypte. Tout récemment encore, l'un des experts les mieux avertis en la matière, M. Harold-Edwin Hurst a consacré au sujet un maître-livre qui fera longtemps autorité.

Mais la richesse même de la documentation impose un choix. Nous interessant à l'histoire de la technique, nous avons cru bon d'esquisser, avec le recul du temps si utile en l'occurence, une synthèse[3] des efforts des hommes qui, au XIXe siècle, voulurent doter l'Egypte d'un système d'irrigation plus satisfaisant, en nous bornant du reste à l'examen des projets de barrages-réservoirs en Egypte. En effet, dans ces projets, l'on trouve en germe et souvent clairement exprimées les idées qui inspirèrent en définitive les réalisateurs du barrage

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(1) Communication présentée en séance le 7 février 1955.

(2) *Bull. Inst. égyptien*, 4e Sér., N°. 5, fasc. I, 1904, p. 9.

(3) On sait que de nombreux écrits ont été publiés sur les irrigations en Egypte en général, et sur les projets de barrages-réservoirs au XIXe Siècle en particulier. Dans la bibliographie terminant cette communication, nous rappelons ceux qui ont semblé les plus importants et indiquons les diverses éditions des ouvrages didactiques de BAROIS et de WILLCOCKS. On pourra également lire d'intéressants développements sur la question qui nous occupe dans F. CHARLES-ROUX, *Le Coton en Egypte*, p. 248-256.

d'Assouan; d'autre part, les recherches du passé peuvent être fort utiles aux ingénieurs qui, demain, auront la responsabilité d'améliorer l'ensemble des ouvrages en service aujourd'hui. Notre exposé s'arrêtera à l'année 1898. Nous ne dirons d'autre part, rien de l'aspect politique de certaines questions traitées.

Une analyse approfondie permet de constater qu'à partir de 1880, triompha lentement un principe oublié depuis l'époque ptolémaïque : celui de l'intérêt qui s'attachait à mettre en réserve, pendant la crue, une partie des eaux du fleuve, en vue de leur utilisation durant l'étiage. Notre propos est de montrer dans quelles conditions furent élaborées et soutenues les thèses des instigateurs de ce que nous appellerons l'aménagement du Nil dans le temps. Au cours de nos développements, nous aurons à rendre hommage à de nombreux efforts individuels. Disons immédiatement que les noms de Linant de Bellefonds(1) de La Motte(2), de Jacquet(3) de Whitehouse(4),

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(1) Louis-Maurice-Adolphe LINANT de BELLEFONDS naquit à Lorient le 29 novembre 1799 et mourut au Caire le 9 juillet 1883. Cet ingénieur autodidacte français, et non belge comme on l'écrit trop souvent, termina sa carrière au service égyptien en qualité de Ministre des travaux publics. On pourra consulter à son sujet la notice de Victor VIDAL, *Vie et œuvre de Linant Pacha de Bellefonds* (*Bull. Soc. Géogr. Egypte*, Sér. II, N⁰ 5, 1884, p. 237-246), et notre étude parue dans la *Revue des Conférences françaises en Orient* 9e an, N⁰ 12, déc. 1945, p. 705 - 718.

(2) Nous savons peu de chose sur le comte A. de LA MOTTE : nous ignorons son prénom complet et les renseignements usuels d'état-civil, si ce n'est qu'il mourut avant 1897 (*Mém. Ing. Civils de France*, 1897, t.I, p. 741). Son nom est souvent, orthographié de manière défectueuse : nous avons vu écrire : "LA MOTHE" et "LAMOTH". bien qu'il ait été directeur technique de la Société des Etudes du Nil nous ne croyons pas qu'il ait été formé dans une Ecole d'Ingénieurs. Ses écrits, que nous citons dans la bibliographie terminant cette étude, donnent l'impression que La Motte était un homme ayant de vastes conceptions mais qu'il ne les présentait pas toujours avec l'art d'un Lesseps.

(3) Louis JACQUET naquit à Villefranche sur Saône (Rhône) le 15 avril 1825 et mourut à Paris le 6 janvier 1890. Elève de l'Ecole polytechnique en 1844 puis de l'Ecole des Ponts et Chaussées en 1846, il fit presque toute sa carrière en France dans le corps des Ponts et Chaussées dont il devint Inspecteur Général en 1883. Il obtint le 13 février 1882 un congé de six mois pour venir en Egypte pour le compte de la Société du Nil.

Il existe sur son compte une notice nécrologique parue dans le tome I de 1890 des *Annales des Ponts et Chaussées.*

(4) L'Américain Frédéric Cope WHITEHOUSE naquit à Rochester (New York) le 9 novembre 1842. Fils d'un pasteur, il fit des études juridiques à l'Université de Columbia puis voyagea en France, en Italie et en Allemagne. Il s'adona aux

de Prompt(1), de Garstin(2) et surtout de William Willcocks(3) doivent être rappelés comme ceux de bons serviteurs de l'Egypte(4).

études archéologiques et fit de longs séjours en Egypte où il fut le défenseur de l'idée de l'aménagement de l'ouadi Rayan. Il publia de très nombreux articles dans des revues diverses. Il mourut à New-York le 16 novembre 1911.

(1) Alexandre PROMPT naquit à Carthagène (Colombie) le 29 août 1826 d'un père ancien officier de l'armée impériale qui s'étant compromis en 1815 au retour de Napoléon avait dû s'exiler. Elève de l'Ecole polytechnique de 1845 à 1850, Prompt fit carrière en France et en Espagne. Il devint Inspecteur général en 1886 et fut mis à la disposition du Gouvernement égyptien le 21 avril 1889 pour remplir les fonctions d'administrateur des Chemins de fer et des Télégraphes et du Port d'Alexandrie en remplacement de Timmerman. Il demeura à son poste jusqu'en septembre 1898, faisant preuve de compétence et d'énergie ce qui lui acquit une grande autorité. Il mourut à Paris le 29 juin 1901.

Son éloge funèbre a été publié dans les *Annales des Ponts et Chaussés*, 1902, t.I, p. XI—XIII.

(2) William-Edmund GARSTIN naquit aux Indes le 29 janvier 1849 et mourut à Londres le 8 février 1925. Il fit ses études en Angleterre puis fut ingénieur des Irrigations des Indes de 1872 à 1885, année au cours de laquelle il fut appelé en Egypte. En 1892 il devint Inspecteur général des Irrigations et sous-secrétaire d'Etat au ministère des Travaux publics, poste qu'il remplit jusqu'en 1906. Il s'occupa particulièrement de la construction du barrage d'Assiout et de celle du barrage d'Assouan Il devint en 1907 Administrateur de la Compagnie du Canal de Suez.

(3) William WILLCOCKS, né aux Indes en 1852, mourut au Caire le 28 juillet 1932. Ce fut, croyons-nous, le plus grand Ingénieur hydraulicien ayant pris part aux projets et aux travaux d'aménagement du Nil. Appelé en Egypte en 1883 par SCOTT-MONCRIEFF, il joua un rôle important dans la réfection des barrages de la pointe du delta. Nommé Directeur Général des réservoirs en Egypte en 1889 il étudia de de 1890 à 1894 les divers projets auxquels on avait pensé. Il devint à partir de cette date un expert de réputation mondiale, et poursuivit dans plusieurs pays une carrière féconde. Willcocks a laissé de nombreux rapports techniques dont celui de 1894, *Report on perennial Irrigation* est le plus connu. Il est surtout l'auteur du livre *Egyptian Irrigation* dont il donna trois éditions, la dernière avec la collaboration de J.I. CRAIG. Enfin on ne saurait trop apprécier son volume de souvenirs, *Sixty Years in the East.*

C. AUDEBEAU lui a consacré une notice nécrologique (*L'Egypte agricole*, août - sept. 1932, p. 434-436) dans laquelle il dit grand bien du défunt. On trouvera dans préface du *Sixty Years in the East* la reproduction d'un assez grand nombre d'articles nécrologiques sur WILLCOCKS.

(4) On notera que plusieurs ingénieurs britanniques qui exercèrent en Egypte, avaient acquis auparavant une grande expérience aux Indes. On peut se rendre compte par la lecture de la 3ème Edition de *Egyptian Irrigation* et de *Sixty Years in the East* de l'importance de cette remarque.

Pour préciser une expression que nous venons d'employer, l'on peut dire que, de nos jours, l'aménagement des eaux du Nil est réalisé tout à la fois dans l'espace et dans le temps.

La nature elle-même a suggéré aux riverains du Nil le système d'irrigation par bassins, pratiqué depuis la plus haute antiquité. Dès l'époque pharaonique également, on a creusé un réseau de canaux amenant l'eau du fleuve sur l'ensemble des terrains suffisamment bas. On conçoit aisément que l'alimentation de ces canaux puisse être facilitée par l'édification de barrages de retenue et que l'irrigation des terres élevées soit rendue possible par l'emploi de machines élévatoires allant du chadouf et de la saquieh aux pompes les plus modernes. Bassins, canaux, barrages de retenue, machines élévatoires constituent autant de modes d'aménagement des eaux dans l'espace, que l'on doit évidemment distinguer de l'aménagement dans le temps, qui, lui, exige des réservoirs.

Or, à quelques exceptions près, que nous indiquerons, l'on peut dire que jusqu'aux environs de 1880 et même plus tard, l'on s'attacha surtout à l'aménagement du Nil dans l'espace. Pendant la première moitié du XIX[e] siècle, on creusa un grand nombre de canaux. On s'interessa aussi aux barrages de retenue de la Pointe du Delta, et du Gebel Silsileh. Certes, les barrages de la Pointe du Delta ou de Saidieh que Linant ne put commencer sérieusement, constituèrent pour Mougel un demi-échec puisque, avant l'intervention de Scott-Moncrieff(1) en 1884, la retenue maxima créée ne dépassait pas 1^{m},75 (2). Il est également vrai de dire que le barrage noyé dit du Gebel Silsileh situé, comme on le sait, à 55 kilomètres à l'aval d'Assouan, ne fut jamais entrepris. Mais si le projet ne fut pas réalisé, on y pensa sérieusement puisqu'il fut étudié dès 1833 par Linant de

(1) Colin Campbell SCOTT-MONCRIEFF né en Ecosse le 3 août 1836, officier du génie et ingénieur aux Indes de 1857 à 1883, fut sous-secretaire d'Etat au Ministère des Travaux publics de 1883 à 1891, chargé des irrigations. Il mourut le 6 avril 1916.

Un portrait de SCOTT-MONCRIEFF et des indications biographiques le concernant se trouvent dans le numéro d'octobre 1895 de la *Revue d'Egypte* en frontispice et pages 257-258.

(2) Sur l'histoire de ces barrages, consulter par exemple BAROIS, *Les irrigations en Egypte*, 2e Ed., p. 314 et suivantes, et WILLCOCKS, *Egyptian Irrigation*, 3e Ed. ,el I, p. 632-655.

Bellefonds(1) et soumis aux membres de la Commission Internationale du Canal de Suez en 1856(2).

Enfin l'irrigation par pompage mécanique fut largement pratiquée en Egypte à partir du milieu du XIX[e] siècle et on construisit en particulier des stations élévatoires à vapeur à Nag Hammadi, à Khatatbeh, à l'Atfeh(3).

Il est digne de remarquer également qu'un peu après 1880 encore, de bons esprits, spécialistes des irrigations en Egypte, n'envisageaient guère pour l'avenir que le développement des moyens précédents. C'est ainsi qu'en 1884, l'ingénieur Félix Paponot préconisait la mise en état des barrages de la pointe du delta, la construction de cinq nouveaux barrages de retenue, le creusement ou l'amélioration de divers canaux, travaux estimés par lui à six millions de livres au total(4) Mais Paponot ne disait pas un mot de l'aménagement du Nil dans le temps : l'intérêt des réservoirs de crue lui échappait totalement.

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A priori, il est possible de créer un tel réservoir soit en utilisant une dépression naturelle reliée à la vallée du Nil par un ou mieux par deux canaux, soit en édifiant dans le lit même du fleuve un barrage émergeant d'assez grande hauteur. Bien entendu il faut que les lieux s'y prêtent. Dans le premier cas, la dépression doit être à peu près étanche; dans le second, de la création du barrage doit pouvoir résulter la formation d'une vaste cuvette et bien entendu toutes les conditions techniques indispensables doivent être remplies(5).

(1) Cf. LINANT, *Mémoires sur les principaux travaux*, p. 397-405.

(2) Le rapport de la Commission a été reproduit dans le livre de Felix PAPONOT, *L'Egypte* : son avenir agricole et financier p. 35 - 42.

(3) Cf. Nubar, *Les Irrigations en Egypte*, mémoire paru dans le *Génie civil* en 1886.

(4) F. PAPONOT, *op. cit.* p. 220-226.

(5) Les spécialistes sont d'accord pour estimer que la conception et l'exécution d'un barrage sont toujours choses fort difficiles à conduire à bien. Il est arrivé assez souvent dans le passé, que des barrages-réservoirs mal conçus ou mal exécutés aient été brusquement détruits, les ruptures entraînant parfois la mort de plusieurs centaines d'individus habitant à l'aval des ouvrages. Parmi les accidents qui causèrent, à l'époque, le plus d'émotion, il y a lieu de citer la destruction du barrage de Bouzey (Est de la France) survenue le 27 avril 1895, celle du barrage sur le Gleno (Lombardie) qui eut lieu le 1[er] décembre 1923, celle du barrage de San-Francis (Californie) qui qui se produisit vers minuit dans la nuit du 12 au 13 mars 1928.

Au début de cet exposé nous avons fait allusion au lac Moeris. Notre objet n'est ni de retracer l'histoire de son emplacement, ni de rappeler les nombreuses thèses soutenues à son sujet, mais seulement de souligner que Bonaparte a peut-être envisagé des travaux analogues à ceux réalisés dans l'Antiquité par Amenemhat II et surtout que Fréderic Cope Whitehouse fut le pionnier de l'idée de l'aménagement de l'ouadi Rayan, projet auquel on donna parfois le nom de "moderne Moeris".

Bonaparte a écrit textuellement : "Les huit ou dix milliards de toises cubes d'eau qui se perdent chaque année dans la mer, seraient répartis dans toutes les parties basses du désert, dans le lac Moeris, le lac Mareotis et le Fleuve sans eau(1) jusqu'aux Oasis (2) et beaucoup plus loin du côté de l'ouest, du côté de l'est, dans les lacs Amers et toutes les parties basses de l'Isthme de Suez et des déserts entre la mer Rouge et le Nil; un grand nombre de pompes à feu, de moulins à vent, éléveraient les eaux dans des chateaux d'eau d'ou elles seraient tirées pour l'arrosage(3)". On peut donc légitimement considérer que Bonaparte avait pensé un à aménagement du fleuve dans le temps.

Lorsque, de plus, un barrage de grande hauteur doit être édifié dans le lit même d'un grand fleuve, les sujétions s'accroissent considérablement : sans qu'il soit besoin de démonstration mathématique, on conçoit évidemment qu'un barrage doit être fondé sur un sol sain dont les fissures, s'il en existe à l'origine doivent être bouchées de manière parfaite pour éviter ce que l'on appelle des "sous-pressions" pouvant causer la ruine de l'ouvrage. Bien entendu, l'ouvrage doit résister à la pression statique de l'eau comme aux effets dynamiques des courants; il est indispensable que des dispositions soient prises pour que les crues les plus violentes soient évacuées sans production de "lame déversante" sur les ouvrages qui n'ont pas été prévus pour cela. Il convient enfin que, pendant les crues, lorsque le fleuve charrie un "débit solide" important, le dit débit solide soit évacué vers l'aval et ne se dépose pas au fond du réservoir créé par le barrage.

(1) W. JUNKER découvrit le premier, au cours d'un voyage commencé en novembre 1875, que le soi-disant "Fleuve sans eau" n'avait jamais été un ancien bras du Nil (*Bull. Soc. Géogr. d'Egypte*, 1ère Série, No. 7, fév. 1880, p. 37 - 43).

(2) En fait les deux seules dépressions véritables situées à proximité de la vallée du Nil, dont le fond est plus bas que le lit voisin du fleuve, sont le Fayoum et l'ouadi Rayan comme l'a reconnu W. WILLCOCKS entre 1891 et 1893 (*Sixty years in the East*, p. 128). Les oasis de Kharga et de Dakleh sont effectivement au-dessous du niveau de la mer mais à une telle distance de la vallée du Nil qu'il est exclu des possibilités pratiques d'y envoyer les eaux du fleuve par un canal.

(3) *Correspondance de Napoléon*, t. XXIX, p. 429.

L'œuvre de Whitehouse eut un double aspect. Pour retracer aussi minutieusement que possible l'histoire du lac Moeris, il se livra à des investigations étendues dont on trouve l'exposé dans un grand nombre de mémoires publiés entre 1881 et 1893. Sur le plan technique et économique, il s'efforça, vainement d'ailleurs, de faire aboutir ses idées sur l'utilisation de l'ouadi Rayan. Nous présumons que Whitehouse avait des capitalistes derrière lui, mais nous n'avons trouvé aucun document qui nous permette de confirmer ou d'infirmer cette hypothèse.

La cuvette de l'Ouadi Rayan signalée pour la première fois à l'époque moderne par Linant de Bellefonds, est située à l'ouest du Nil et au sud du Fayoum. Le fond de la dépression est en général à une quarantaine de mêtres au-dessous du niveau de la mer(1). Elle est séparée du Fayoum par une crête calcaire dont l'altitude varie en général de (+ 30^{m},00) à (+60^{m},00) et dont le minimum est à la cote (+ 26^{m},00) en quelques seuils d'une faible longueur que les protagonistes de projet ont proposé de boucher par des digues. A la cote (+ 30^{m},00) le volume de la dépression est de l'ordre de 21 milliards de mètre cubes, à la cote (+ 22^{m},00) de l'ordre de 16 milliards de mètres cubes. Ces cotes sont d'autre part celles du Nil à Beba, en face de l'ouadi Rayan respectivement lors des crues moyennes et à l'étiage. On conçoit comment l'ouadi Rayan pourrait théoriquement être aménagé en réservoir : il conviendrait de construire un canal d'amenée et un canal de fuite ainsi que divers ouvrages de contrôle; puis de remplir le réservoir pendant la crue et de le vide pendant l'étiage. Compte tenu des pentes indispensables à l'écoulement de l'eau dans les canaux, compte tenu des pertes d'eau par infiltration et par évaporation, la capacité utile du réservoir serait bien inférieure à 5 milliards de mètres cubes, différence entre 21 et 16 milliards. On pourrait escompter que l'ordre de grandeur en serait de 1.500 millions de mètres cubes(2). Les partisans de l'aménagement de l'ouadi Rayan ont fait observer que l'exécution des travaux ne présenterait aucune difficulté technique exceptionnelle et qu'a priori,

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(1) La profondeur de 40^{m},00 a été donnée par la majorité des auteur Cyril S. Fox a fait état d'une cote de 60^{m},00 dans son mémoire (*The geological aspects of the Wadi Rayan projects*), (Cf.p. 19).

(2) Il ne s'agit évidemment que d'un chiffre indicatif.

la réussite définitive ne comporterait qu'un seul aléas, celui de l'étanchéité des terrains de la dépression(1).

Quoi qu'il en soit, si la propagande de Whitehouse s'exerça pendant de longues années, c'est surtout en 1887 et 1888 que la question fut étudiée avec le plus de soin.

Dans une lettre au marquis de Salisbury en date du 19 octobre 1887, Whitehouse insistait sur l'intérêt de son projet. Quelques jours plus tard, malgré certaines réserves faites par Scott-Moncrieff dans une Note du 9 novembre, les ingénieurs du Gouvernement égyptien G. A. Liernur et le colonel James Halifax Western(2) firent alors des relevés détaillés. Scott-Moncrieff exprima ensuite son opinion définitive dans deux notes datées des 5 avril et 11 décembre 1888 dans lesquelles il concluait que la situation financière de l'Egypte ne permettait pas d'entreprendre l'aménagement de l'ouadi Rayan et qu'il n'était pas davantage souhaitable de concéder les travaux à une soiciété privée.

Malgré cela, William Willcocks, dans la première édition de son livre sur les irrigations en Egypte, parue en 1889, présentait les projets de Whitehouse avec beaucoup de sympathie(3) alors qu'il consacrait quelques lignes seulement à un autre projet, du reste, antérieur à celui de l'ouadi Rayan, celui du barrage de Silsileh.

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Dans deux volumes parus en 1867 et 1868 et consacrés aux affluents du Nil en Abyssinie, Samuel Baker(4) avait montré l'intérêt

(1) Nous n'avons pas à traiter ici l'état actuel de la question de l'aménagement de l'ouadi Rayan. On pourra se reporter aux études de Cyril S. For d'un part, à celles de M. Marcel JUNGFLEISCH d'autre part, pour connaître en détail la thèse favorable et la thèse hostile au projet.

(2) Cet officier du génie naquit en 1844 et vint en Egypte en 1884.

(3) Il nous a été rapporté qu'à la fin de sa vie, Willcocks avait une position bien différente au sujet de l'ouadi Rayan.

(4) Samuel White BAKER naquit à Londres le 8 juin 1821 et mourut en 1893. On sait que ce fut l'un des explorateurs les plus célèbres du XIXe siècle.
Willcocks qui avait bien connu Samuel Baker porte sur les ouvrages que nous venons de citer le jugement suivant: "Il have always considered that Sir Samuel's books on the Upper Nile and its tributaries are some of the best books of the kind ever written" (*Sixty Years in the East*", p. 135).

de barrer le Nil en divers endroits et avait même indiqué le site d'Assouan comme un point particulièrement favorable à l'édification d'un barrage. Les idées de Baker parurent fort intéressantes à un Français, A. de la Motte qui fut aussi, très certainement, impressionné par le succès du percement de l'Isthme de Suez. Il n'est pas douteux en effet, que l'affirmation de la réussite du canal creusé par Lesseps, malgré toutes les difficultés rencontrées, eut pour conséquence indirecte l'éclosion de beaucoup de "grands projets" dont quelques uns étaient utopiques mais dont certains furent réalisés par la suite.

Quoi qu'il en soit, La Motte fut convaincu de l'intérêt qui s'attachait à la régularisation du Nil par la création de réservoirs. Aussi, après de longues années de lectures, et de recherches théoriques, La Motte vint-il en Egypte en 1880, afin de trouver sur place une solution satisfaisante aux problèmes qui le préoccupaient. Revenu en France il exposa en public ses idées au cours de deux conférences prononcées à la Société de Géographie en juillet et en décembre 1880, résumant son programme dans les phrases suivantes : "Il faut relever le plan du Nil en réparant les seuils usés, créer de grands réservoirs pour régler le débit du fleuve suivant les besoins, livrer à la culture toute l'eau du fleuve avant qu'elle n'aille à la mer" (1).

L'année suivante, en 1881, était fondée la *Société d'Etudes du Nil* comportant un groupe français et un groupe britannique. Le Président de la Société fut le baron de Langsdorff et l'Administrateur délégué le vicomte de Charnacé. La Motte étant désigné comme directeur technique. D'autre part, en 1882, la Société demanda à l'ingénieur en Chef des Ponts et Chaussées Louis Jacquet, de se rendre en Egypte en vue d'étudier sur place le premier ouvrage à exécuter que la Société estima devoir être implanté au Gebel Silsileh. Il s'agissait, par une retenue pouvant varier de 20 à 25 mètres, de transformer la plaine de Kom Ombo en un réservoir dont la capacité utile eut été de 7 à 8 milliards de mètres cubes. Les ouvrages prévus étaient les suivants. Tout d'abord, l'on aurait édifié un barrage mobile de 300 mètres de long dans un chenal dérivé où, ultérieurement, le Nil serait passé, le lit actuel ayant été barré par un ouvrage fixe. Il en eut été de même d'un ancien lit du fleuve situé sur la rive droite. Il y aurait encore eu un déversoir de 700 mètres de longueur, le départ d'un canal d'irrigation prévu pour débiter 400 à 500 mètres-cubes

(1) *Deuxième conférence*, p. 9.

seconde, et enfin une chaîne d'écluses(1). L'ordre de grandeur des dépenses indiquées par Jacquet était de 4 millions de livres égyptiennes. L'ouvrage une fois exécuté aurait permis d'atténuer les fortes crues, de pallier les effets des crues trop faibles, d'irriguer des surfaces étendues en aval du barrage.

Il convient de noter que les relevés topographiques effectués à l'époque n'avaient pas été extrêmement précis et l'on trouva plus tard que l'érection du barrage de Silsileh aurait eu pour conséquence de noyer, en partie du moins, la ville d'Assouan.

Le 11 mars 1883, Langsdorff, Charnacé et La Motte remirent au Ministre des Travaux publics, Aly pacha Moubarak, une note détaillée des premiers travaux de la Société, accompagnant une demande de concession avec garantie d'intérêt et participation aux bénéfices éventuels résultant de la construction du barrage. L'année 1884 fut marquée par une propagande assez intense, faite ou inspirée par la Société d'Etudes du Nil, en particulier par une communication très claire de l'Ingénieur Charles Cotard(2) à la Société des Ingénieurs civils de France. En 1885, de longues tractations furent de nouveau conduites par la Société d'Etudes du Nil avec le Gouvernment égyptien; la Société ayant déjà dépensé 30.000 livres sterling en frais d'études aurait désiré que ces dépenses fussent remboursées par le Gouvernement et que celui-ci avançât encore 50.000 livres sterling en vue de poursuivre les projets d'aménagement du fleuve. De plus la Société demandait à nouveau que lui soit concédée la construction du barrage et qu'on lui assurât une participation aux bénéfices. Le Gouvernement fut effrayé par les dépenses envisagées et voulut réserver pleinement sa liberté d'action. Bref, les pourparlers n'aboutirent pas. Pourtant la Société ne s'avoua pas battue : son ingénieur-conseil Jacquet étant mort en janvier 1890, elle choisit comme successeur un hydraulicien connu, L. Fargue qui, dans un rapport daté du 15 novembre 1891, traçait dans les termes suivants le programme des travaux à exécuter en Egypte : "Reconstruire le régime primitif du Nil supérieur en relevant à son ancien niveau l'étiage du fleuve, qui

(1) Voir la planche No. 65 du livre de CHELU, *Le Nil, le Soudan, l'Egypte.*

(2) Né à Issoudun le 23 juin 1835, mort à Constantinople le 12 novembre 1902, cet ingénieur eut une carrière bien remplie en France, en Italie, en Egypte, en Russie et en Turquie. (Cf. Notice nécrologique par Brull, (*Mém. Soc. Ing. civils de France*, oct. 1903).

a subi des abaissements considérables — rétablir les vastes réservoirs et les bassins de cultures de l'antique Haute-Egypte, — atténuer les écarts des crues, — et augmenter le volume disponible, pour augmenter les irrigations pendant la saison d'étiage"(1). C'était, à peu de chose près, ce qu'avait exposé La Motte.

D'autre part, à partir de 1882, plusieurs ingénieurs établis en Egypte s'intéressèrent de près aux études de la Société du Nil; on peut citer les noms de Jules Gallois, de Léon Leygue et surtout de Jean-Gustave Baudot ingénieur en Chef du Chemin de fer Kéneh-Louqsor-Assouan qui reprit et adapta le projet de Jacquet. Les études de Baudot firent le 4 juin 1897 l'objet d'une communication d'Edmond Badois à la Société des Ingénieurs civils de France. L'on peut du reste considérer que Baudot était à cette époque également inspiré par les idées d'Alexandre Prompt sur l'œuvre duquel nous aurons à revenir.

La Société d'Etudes du Nil, comme plus tard Whitehouse, œuvra incontestablement dans un but mercantile, le mot n'étant, bien entendu, pas pris avec une acception péjorative. Il n'en reste pas moins qu'elle contribua puissamment à diffuser certaines idées très utiles à l'Egypte. C'est par exemple dans une de ses publications que Georges Lemoine attira l'attention des spécialistes sur l'utilité de la création d'un service hydrométrique en Egypte. Enfin, les travaux de reconnaissance entrepris par la Société furent utiles dans la suite.

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En mai 1889 arrivait en Egypte un inspecteur général des Ponts et Chaussées en retraite, Alexandre Prompt, nommé par le Gouvernement égyptien Administrateur des Chemins de fer et des Télégraphes égyptiens et du Port d'Alexandrie. C'était un homme énergique et tenace qui fut tout de suite conquis par l'Egypte et ses problèmes. D'autre part, il avait évidemment l'âme d'un grand commis, sachant servir avec compétence, dévouement et désintéressement. Il n'y a pas lieu de parler ici de l'œuvre de Prompt relative aux Chemins de fer égyptiens malgré son importance, mais seulement de mettre en vedette ses idées relatives à l'aménagement du Nil, idées qui furent

(1) *Consultation*, de Léon Gallard, p. 3.

exposées à la tribune de l'Institut égyptien dans huit communications différentes. En se reportant au texte de ces études, on trouve clairement exposés l'ensemble des problèmes relatifs à l'aménagement du Nil en Egypte et au Soudan tels qu'ils se présentaient à la fin du XIX[e] siècle. Il ne saurait être question de donner une analyse même sommaire de tous ces documents.

Qu'il suffise de dire que dès le 27 février 1890, Prompt présentait au Gouvernement un rapport dans lequel il exprimait tout l'intérêt offert par la construction de barrages-réservoirs sur le Haut-Nil et indiquait l'emplacement du premier-réservoir à édifier comme devant être dans les étroits de Kalabcheh à une cinquantaine de kilomètres au sud d'Assouan. Un an plus tard, le 6 février 1891, l'ingénieur français exposait ses idées à l'Institut égyptien dans une communication très remarquée : les élites du Caire purent ainsi avoir des précisions sur le barrage projeté par Prompt : d'après lui, il convenait de créer dans le lit même du fleuve une muraille dont la hauteur eut dépassé de 16 mètres la cote de l'étage, ce qui eut créé un réservoir d'une capacité de un milliard et demi ou deux milliards de mètres cubes. Dans sa communication, Prompt ne donnait que peu de détails d'ordre technique, mais insistait en revanche sur l'intérêt économique que devait présenter la construction du barrage.

Les années suivantes, Prompt revint sur la question du barrage de Kalabcheh mais suggéra aussi l'aménagement du Nil au Soudan et souligna l'importance de "la puissance électrique des cataractes" et l'utilisation du "charbon blanc en Egypte".

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* *

Nous avons vu qu'avant les campagnes de La Motte et de Whitehouse, et même un peu après, l'intérêt que pouvait présenter l'aménagement du Nil dans le temps, n'était nullement apparu à certains esprits. En tous cas, de 1880 à 1890, les ingénieurs responsables du Ministère des Travaux publics au Caire ne s'en montrèrent guère partisans. Ni L. Rousseau, ni après lui Scott-Moncrieff, du moins dans les premières années de ses fonctions, ne furent séduits par les projets de grands réservoirs. Ils furent quelque peu hypnotisés par les dépenses considérables à engager sans peut-être bien comprendre que ces dépenses étaient rentables.

Aussi le rapport présenté par Prompt au début de 1890, fut-il très utile et cette même année on décida d'etudier officiellement les projets de barrages-réservoirs du Nil. William Willcocks qui en fut chargé était certainement l'ingénieur au service du gouvernement à cette épouque le mieux qualifié pour cette étude. Grâce à ses rapports du 1[er] mai 1891 et du 25 novembre 1893, on peut avoir une vue très nette de la consistance des projets tandis que l'on trouve dans les souvenirs de l'ingénieur, intitulés *Sixty years in the East* des précisions complémentaires qui, pour n'avoir pas un caractère administratif, n'en sont pas moins fort intéressantes. Willcocks fut assisté dans ses travaux d'une équipe d'ingénieurs anglais, égyptiens et français à qui il a rendu hommage(1).

Willcocks étudia en détail toutes les solutions raisonnables possibles et put dresser le tableau comparatif suivant des divers projets(2).

Emplacements	Cote maxima	Volume d'eau utilisable	Estimation de la dépense
	mètres	milliards de m³	millions de livres
Kalabcheh	115	1,8	1,3
	118	2,6	1,6
Sud de Philae	115	2,7	1,8
	118	3,6	2,1
Cataracte d'Assouan	105	0,9	0,8
	115	2,7	1,4
	118	3,7	1,7
Silsileh	100	2,4	1,6
	104	3,5	1,9
Ouadi Rayan	27	1,0	2,0

(1) Il s'agissait d'Abdallah Hassib, d'Abdallah Rifaat, d'Abdel Rahman Rouchdi, d'Amin Abd el Bar, de Clifton, d'Hewat, de Mohamed Balig, de Mohamed Choukri, de Mohamed Saber, de Roux et de Stent.

(2) Le tableau de Willcocks du *Rapport sur l'irrigation perenne*, p. 41 est présenté de manière un peu différente. Nous avons d'autre part arrondi certains nombres.

Willcocks estima que le site de la cataracte d'Assouan était de beaucoup préférable : la réalisation entraînait un minimum d'habitations noyées et la constitution géologique était la meilleure. En vue de diminuer les dépenses, W. Willcocks proposa de construire un ouvrage comportant cinq tronçons (1). Pourtant le choix d'Assouan avait un grave inconvénient d'ordre archéologique. Adopter une retenue importante aurait eu pour conséquence de noyer le temple de Philae. A l'époque, cette idée était considérée comme sacrilège.

Le sous-secrétaire d'Etat William Edmund Garstin fit à son tour une étude comparative très soignée et consulta Robert Hanbury Brown (2) et Edward William Percival Foster(3) alors inspecteurs généraux des Irrigations de Haute et de Basse-Egypte. Finalement Garstin dans sa Note du 27 décembre 1893 classa dans l'ordre suivant les quatre projets qu'il retint en définitive(4).

Emplacement	Cote moyenne de la retenue	Coût des réservoirs	Coût des travaux pour l'utilisation de l'eau	Coût total
mètres		millions de L. E.	millions de L.E.	millions de L.E.
Assouan	114	1,6	3	4,6
Kalabcheh	118	1,6	3	4,6
Silsileh	101	1,7	3	4,7
Ouadi Rayan	27	2,7	2,5	5,2

Sa conclusion était la suivante : "En ce qui regarde le barrage-réservoir de la cataracte d'Assouan, je le place en première ligne uniquement à cause des avantages qu'il offre au point de vue de l'art de l'ingénieur. Je sais parfaitement que la difficulté qui se dresse à propos du temple de Philae est très sérieuse et qu'à elle seule peut-être, probablement pour mieux dire, elle amènera le rejet du projet. C'est là une question qu'il appartient au Gouvernement de décider".

(1) Voir la planche 8 de l'atlas accompagnant le rapport de Willcocks. et la figure p. 6 de *The Nile Reservoir Dam at Assouan* (2e Ed,).

(2) Né à Brixton Hill le 13 janvier 1849, il mourut le 4 mai 1926.

(3) Né le 26 décembre 1850, décédé le 30 septembre 1932.

(4) *Note sur l'irrigation perenne*, p. 55.

Ce dernier designa alors une commission de trois ingénieurs hydrauliciens de grande réputation : Benjamin Baker(1) de Londres, Auguste Boulé (2) de Paris et Giacomo Torricelli de Rome. Ces trois experts furent invités à se prononcer sur la valeur respective des projets.

Du 27 février au 22 mars 1894 la Commission visita minutieusement les lieux et continua ses délibérations jusqu'au 10 avril. Des désaccords graves surgirent du reste en son sein(3). Baker et Torricelli préférèrent le projet d'Assouan n'attachant pas au problème de Philae une importance exagérée. Samuel Baker estima même qu'il serait possible d'élever en bloc le niveau de Philae d'une quinzaine de mètres. Le projet ne parut du reste guère praticable à tous les techniciens. Boulé au contraire jugea qu'il serait préférable de construire un barrage à Kalabcheh. Il proposa un ouvrage tout à fait original qu'il appela "barrage à cascades" qui eut été constitué par des piles entre lesquelles eussent été édifiées une série de vannes mobiles dont aucune n'aurait jamais été soumise à une pression de plus de 6 mètres d'eau. Dans ce bref exposé nous ne décrirons pas en détail le projet de l'inspecteur général français. Qu'il suffise de dire, que selon son auteur, l'emmagasinage d'un mètre cube d'eau aurait coûté 0f,008 avec son projet tandis qu'il devait coûter 0f,016, c'est-à-dire le double avec le barrage d'Assouan.

En qualité d'ingénieur, nous pensons du reste que le projet Boulé était relatif à un ouvrage fragile et peu satisfaisant pour l'esprit.

Quoi qu'il en soit, ce fut à Assouan que l'on construisit le barrage; le retenue maxima fut seulement de 106^{m} par égard pour Philae; le tracé fut rectiligne et l'ouvrage unique et non pas fractionné comme l'avait suggéré Willcocks.

(1) Benjamin Baker né à Keyford, Frome (Somerset) le 3 mars 1840 mourut à Pangbourne(Berks) le 19 mai 1907; il fut ingénieur-conseil du Gouvernement égyptien en plusieurs circonstances.

(2) Adolpe-Philippe-Auguste BOULE naquit à Paris le 11 juillet 1830. Il entra à l'Ecole Polytechnique en 1849 et à l'Ecole des Ponts et Chaussées en 1852. Il se consacra surtout aux problèmes hydrauliques et fut l'auteur du barrage de Suresnes. Il devint Inspecteur général en 1890 et prit sa retraite en 1895.

Il existe une Notice nécrologique sur son compte dans les *Annales des Ponts et Caussées* de 1912, t. VI, p. 459 - 468.

(3) Willcocks a donné à ce propos des détails savoureux dans *Sixty Years in the East*, p. 151-155.

Mais nous nous étions proposé de parler de projets et non pas d'ouvrages exécutés. Il nous faut donc conclure.

Cette conclusion est fournie par la réussite du barrage d'Assouan mais cette réussite est due en grande partie à toutes les études ayant précédé la construction. Il est également conforme à la vérité de rappeler que de nombreuses communications faites à cette tribune eurent un rapport direct avec le sujet qui nous a occupé de soir, alors que huit au moins des ingénieurs que nous avons cités appartinrent, à des titres divers, à l'Institut égyptien(1). C'est que depuis bientôt un siècle, notre compagnie n'a cessé d'apporter d'utiles contributions aux solutions des problèmes intéressant ce pays. Aujourd'hui encore, l'Institut d'Egypte a le droit d'être légitimement fier de sa coopération à l'aménagement du Nil.

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(1) Julien BAROIS, membre résident le 14 janvier 1884, membre honoraire le 4 mars 1905 ;
Hanbury BROWN, membre résident le 30 décembre 1892, membre honoraire le 18 janvier 1909 ;
William GARSTIN, membre résident le 30 décembre 1892, membre honoraire le 18 janvier 1909 ;
Maurice LINANT de BELLEFONDS, membre résident le 20 mai 1859 ;
Alexandre PROMPT, membre résident le 5 janvier 1894, membre honoraire le 19 janvier 1900 ;
Colin SCOTT-MONCRIEFF, membre résident le 14 janvier 1884 ;
Cope WHITEHOUSE, membre correspondant le 5 mars1884 ;
William WILLCOCKS, membre honoraire le 10 janvier 1910.

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(1) Cette bibliographie n'est évidemment pas complète: nous avons cité seulement les ouvrages et articles qui nous ont paru le plus intéressants pour notre sujet; nous n'avons du reste pas pu les consulter tous. Aussi bien on pourra se reporter également aux bibliographies classiques en particulier à celle de MAUNIER (N°s 1772 à 1900).

Nous avons mis plus haut en vedette les rapports étroits existant entre les questions du lac Moeris et de l'aménagement de l'ouadi Rayan. Il en résulte que, pour avoir une vue complète de ce dernier sujet, il n'est pas mauvais d'étudier en détail le premier. Mais il n'entrait pas dans notre plan de présenter une bibliographie exhaustive du lac Moeris. Nous croyons donc devoir renvoyer une étude de Frederic Cope Whitehouse, *Moeris, the Wonder of the World*, p. 14-15; à la bibliographie d'Ibrahim Hilmy t. II, p. 326-327 et surtout à la bibliographie critique de Cyril S. Fox, *The Geological Aspects of the Wadi El Raiyan Project*, p. 8-15.

Enfin, dans ce qui suit nous avons utilisé les sigles suivants :

BIé	Bulletin de l'Institut égyptien.
BSGE	Bulletin de la Société de Géographie d'Egypte.
Gc	Génie civil.
MSICF	Mémoires de la Société des Ingénieurs civils de France.
RIP	Rapport sur l'irrigation perenne, de WILLCOCKS.

(2) La Société d'Etude du Nil a publié plusieurs brochures intitulées : *Le Nil*. L'ensemble peut être considéré comme une revue, ayant paru du reste à intervalles irréguliers.

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Appendice III : Le Nil (38 p.).
Appendice V : Description et résistance des pierres d'Egypte (4 p.).
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(1) Les appendices non-indiqués sont décrits sous les noms des auteurs correspondants, le titre du présent rapport étant abrégé en RIP.

— *Sixty Years in the East*(1).
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(Third Edition) (With an Introduction by Hanbury BROWN. London, Spon, 1913; 2 vol: in-4° (260 × 185) de XXIV + 884 p., 188 fig. et 81 pl. h.t. pour les deux volumes.

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(1) On trouve dans cet ouvrage l'indication d'autres ouvrages de W. WILLCOCKS qui a publié également des mémoires dans diverses revues savantes.

A long term policy for Education Basic Concepts

by

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INTRODUCTION

Education in Egypt has been in a continuous state of change. In the past, tens of committees have been set up, each one pulling down what the preceding recommended. Schools of a certain type were opened for no convincing reason and then closed before they could either show their worth or their uselessness to be opened again and again closed. Projects were changed a few months after their introduction. Laws were enacted which could not possibly be supplemented like the law for compulsory education when there is neither the schools, the teachers nor has anything like an adequate budget been set down.

Thus we feel more acutely in this domain the need for a long term policy. A policy well enough planned to stand the test of time. This does not mean that it must be rigid with no possibility of change, but changes must not be major ones unless a long enough period has elapsed since its introduction. And it must be accompanied with a knowledge of the range of deviat'ons which are to be expected in normal circumstances (i.e. assuming no one-sided cataclysm such as an epidemy that would kill the teachers but not the pupils to happen).

The object of this paper is to give the basic concepts on which must be built such a long term policy. The application of these concepts will be given in another paper.

Long term policies when they involve a major change are based generally on a Ten-Year plan. We shall assume that this is the case

here, though a longer period plan can be used if it seems advisable, from a financial or any other point of view, to do so.

WHAT DO WE WANT

We shall consider this problem in the inverse way : *instead of putting down a plan and then find out what will the state of education be in 10 or 50 years time, we shall start by putting down what we want the state of education to be in the future and from that deduce what the plan ought to be.*

What do we want ? We want that at the end of the ten-year plan

1. — There exists a number of First educational year (first elementary year) classes and teachers sufficient to cope with all children then at school-entrance age and all those that are repeating this class.

2. — There exists the appropriate number of higher classes and teachers in all types of education(1). By the appropriate number we mean a number which increased yearly in the same proportion as the increase in the corresponding population, will be sufficient to cope when the time arises, with that part of the above number of children that are to enter this particular class and the children that are repeating it.

We want that the state of natural increase then following be such that in fifty years time (say) when all persons between 24 and 46 years of age have been through this educational policy, the distribution of the different levels of culture in these persons will be the one most needed by the country.

Thus before planning our policy, we must agree on what will this distribution be. This is, of course, arbitrary and only limited by our financial situation. We could, if we wanted, demand that half the population be university graduates but this would be absurd. Our distribution must be well equilibrated, not too ambitious and must take into account what economists, industrialists etc. predict, also what we want our country to become. Thus, if we want or expect

(1) The case of Teachers Schools is different and will be discussed in the following paragraph.

the country to be highly industrialised, the proportion of persons with a technical culture must be larger than if we did not. Also if we want or expect women to have a large share in the country's economy, the proportion of the corresponding girls schools must be larger.

As we said this distribution may be highly controversial and must be agreed upon; so in this paper, we shall use algebraic symbols o denote the d fferent proportions, any one symbol may be small or large according to the result desired.

THE PROBLEM OF THE TEACHERS

The enlargement in education ncludes two parts :

1. — a material part, building of schools and gathering of material which, given the necessary budget, can be done in a few months.

2. — building the necessary staff : teachers and so like, which demands in general a few years.

We see that this second part must have first prioriy in our plan. Thus we must separate, in our plan, he schools wh ch produce this element namely teachers from the other schools. In other words, we must have a shorter per od plan for teachers schools and colleges.

Another big difference is that teachers schools will not increase at the end of heir plan in a natura way but will be kept at a level such that they produce enough teachers to replace those that are eliminated either hrough death, reaching the age-limit or any other cause and to cover the natural increase in the school children population.

SYMBOLS AND NOTATIONS

Let us denote by :

N the total number of children at school-entrance age in ten years time. This has to be estimated using previous censuses (adjusted figures have been obtained by Shanawani and by Daly) Errors in such an estimation will be less than 5% and the precision can be bettered when he 1957 census returns will be available.

α the yearly relative increase in the population of school age children This again has to be estimated from previous censuses and

can be assumed constant without making a large error. If necessary an estimate depending on the age can be calculated, it is doubtful hat the improvement will be worth while.

t the type of education. The different types of education ought to be well defined at the beginning of the plan and kept constant for a long enough period.

C^t_x the class in the type t of education attained by a child who has studied x-1 years without failing since his joining school at school-entrance age.

Q_t the ratio of children who have quitted schools while in or at the end of type t of education *These numbers ought to be agreed upon.*

r^t_x the ratio of children who are repeating class C^t_x. These ratios are very small in the lower stages of education but they become large in the upper stages. *A proper choice of the children to enter the different types of education may lower them.* They have to be estimated from the results of the previous years and can be assumed, specially in elementary and secondary schools, to be constant inside a type of education.

s^t_x the ratio of children who have succeeded in the examinations of class C^t_x and who in fact join the following class. These also have to be estimated from previous statistics.

n^t_x the number of the children that have to be accomodated in class C^t_x at the end of the ten-year plan or the capacity of the class C^t_x then. These are the most important elements in our study; we shall give in the next paragraphs a method to calculate them.

${}_0n^t_x$ the number of children that can be accomodated now in class C^t_x This number can be found with a very good precision.

R^t the ratio of the number of teachers to the number of pupils in the type t of education. These again are arbitrary and differ from country to country; *they must be agreed upon.*

v^t the number of teachers needed at the end of the ten-year plan in the type t of education.

${}_0v^t$ the number of teachers existing now in type t of education.

$p_6^{(x-1)}$ the survival rate of a child six-year old x-1 years. These are to be estimated since a complete Egyptian mortality table does not exist. Errors in the estimation will not be negligible.

E^t_i The initial expenses per capita in building and furnishing new schools in the type t of education. These can be obtained very accurately.

E^t_c the yearly current expenses per capita in the type t of education. They must be estimated with as good a precision as possible since an error of a few piastres may create a difference of some hundred thousand pounds.

RELATIVE CAPACITY OF THE DIFFERENT CLASSES

To find out in what ratios must be the capacity of the different classes in a certain type of education, let us assume that at the time T = 0 we introduce a new type of education and put a number. M in Class I. Then at the time T = 0, 1, 2,... the number of children in Class I, III, III, ... will be

	T = 0	T = 1	T = 2
in Class I	M	$M(1+\alpha)+Mr_1$	$M(1+\alpha)^2+Mr_1(1+\alpha)+Mr_1^2$
in Class II	0	Ms_1	$Ms_1(1+\alpha)+Ms_1r_1+Ms_1r_2$
in Class III	0	0	Ms_1s_2

In general at time T, we shall have

in Class I $M(1+\alpha)^T + M(1+\alpha)^{T-1} r_1 + M(1+\alpha)^{T-2} r_1^2 + \ldots + Mr_1^T$

in Class II $Ms_1 [(1+\alpha)^{T-1}+(1+\alpha)^{T-2}(r_1+r_2)+(1+\alpha)^{T-3} (r_1^2+r_1r_2+r_2^2) + \ldots + (r_1^{T-1}+r_1^{T-2}+r_2r_1^{T-3}r_2^2+\ldots+r_2^{T-1})]$ t

in Class K $Ms_1s_2 \ldots s_{K-1} [(1+\alpha)^{T-K+1}+(1+\alpha)^{T-K} (r_1+r_2+\ldots+r_K)+ \ldots + (r_1^{T-K+1}+r_1^{T-K}r_2+r_1^{T-K}r_3+\ldots+r_K^{T-K-1})]$

These different quantities can be replaced with a negligible error (less than 1% and positive) by the convergent infinite series whose first T + 1 terms are the above quantities, then we get

the capacity of Class I as $M(1+\alpha)^T \dfrac{1}{1-\dfrac{r_1}{1+\alpha}}$

the capacity of Class II as $M(1+\alpha)^T \cdot \dfrac{s_1}{1+\alpha} \cdot \dfrac{1}{1-\dfrac{r_1}{1+\alpha}} \cdot \dfrac{1}{1-\dfrac{r_2}{1+\alpha}}$

and in general the capacity of Class K as

$$M(1+\alpha)^{T} \cdot \frac{s_1 s_2 s_3 \dots s_{K-1}}{(1+\alpha)^{K-1}} \cdot \frac{1}{1-\frac{r_1}{1+\alpha}} \cdot \frac{1}{1-\frac{r_2}{1+\alpha}} \cdots \frac{1}{1-\frac{r_K}{1+\alpha}}$$

A simplification in the writing can be obtained by putting s for $\frac{s}{1+a}$ and r′ fo $\frac{r}{1+a}$. The capacity of Class K becomes

$$\frac{M(1+\alpha)^{T}\, s_1' s_2' \dots s'_{K-1}}{(1-r_1')(1-r_2')\dots(1-r'_K)}$$

and in particular when K = 1 it becomes $\frac{M(1+)\alpha^{T}}{1-r_1'}$.

The ratio of the capacity of Class K to that of Class K-1 is

$$\frac{M(1+\alpha)^{T} s_1' s_2' \dots s'_{K-1}}{(1-r_1')(1-r_2')\dots(1-r'_K)} \div \frac{M(1-\alpha)^{T} s_1' s_2' \dots s'_{K-2}}{(1-r_1')(1-r_2)\dots(1-r'_{K-1})}$$

$$= \frac{s'_{K-1}}{1-r'_K}$$

and the ratio of the capacity of Class K to that of Class I is

$$\frac{s_1' s_2' \dots s'_{K-1}}{(1-r_2')(1-r_3')\dots(1-r'_K)}$$

CAPACITY OF CLASS C^t_x

Knowing in what ratios must be the capacities of the classes in a certain type of education, all we need to know now is the capacity of Class I in each type of education at the end of the ten-year plan. In this paragraph C^t_x will then denote Class I in type t of education.

To find the capacity n^t_x of the class C^t_x at the end of the ten-year plan, we use the following argument :

This capacity, from then on, will increase in a natural way and so becomes after x–1 years $n^t_x\ (1+\alpha)^{x-1}$. At that time it must be capable of holding that ratio of the survivals of the original N children which have to go through this particular class's education and also hold those that are repeating this class. Thue, it must be equal to

$$\frac{N\ p_6^{(x-1)}}{1-\frac{r_1^t}{1+\alpha}} \quad \sum_{\tau \geq t} Q_t$$

where the summation sign $\sum_{\tau \geq t}$ is taken to cover ratios corresponding to this type and to all types in which children cannot go unless they have passed through that particular type (1).

Therefore

$$n^t_x = \frac{N\ p_6^{(x-1)}}{(1-\frac{r_1^t}{1+\alpha})(1+\alpha)^{x-1}} \quad \sum_{\tau \geq t} Q_t$$

THE TEN-YEAR PLAN

Now that the capacity of the classes at the end of the ten-year plan has been determined all we have to do is to subtract from it the actual (available capacity ${}_o n^t_x$ to get the capacity of the classes to be built during the ten-year plan. This capacity has to be subdivided into ten equal (or in an increasing sequence) parts; each part being built during one of the ten years.

These new school buildings must be divided between the different educational districts according to their population in the lower stages of education. However, for technical and higher education this need not be the case but must fit in with our policy for these districts.

The number v_t of teachers needed at the end of the ten-year plan is calculated easily by multiplying the total number of children in a type of education by the ratio of teachers to pupils in that type of education

$$v_t = \sum_{X} R_t\, n^t_x$$

The difference between this number and the number of still-in-service teachers gives us the number of teachers to be produced during the ten years of our plan. If to produce a teacher we need four years (say), this difference plus the expected failures, quitters and dead must be accomodated in teachers schools during the first six years of our plan.

FINANCING THE PLAN

It remains to find out the amount of the budget necessary on

(1) If a type can be arrived at through different channels, the contribution of each channel must be determined and taken into account.

finance the ten-year plan and also the yearly budget for education after that period.

If, in our plan we have subdivided the new projects into ten equal parts, the yearly budget will be increasing very slowly during the ten years then at the end of this period drop to a much lower level and from then on it will increase in the same proportion as the increase in the population.

The budget will include two parts :

1. — The initial expenses in building and furnishing the schools

2. — The running expenses to keep the school going.

These first (initial) expenses will be large during the ten years of the plan and will be constant (except for variations in prices) if the plan has assumed equal distribution of the new projects over the ten years. After this period they will much smaller as they have only to cover the new schools relative to the natural increase in the population.

The second (current) expenses will increase rapidly during the ten years of the plan, then their increase will be smaller as it will then be parallel to the natural increase in the population.

More precisely the total expenses after T years from the beginning of the plan will be

$$\sum_{t} \left\{ \sum_{x} \frac{n_u^t - {}_on_x^t}{10} E_i^t + \sum_{x} \left[{}_on_x^t + (T-1) \frac{n_x^t - {}_on_x^t}{10} E_c^t \right] \right\}$$

for $T \leq 10$. And for $T > 10$ the total expenses will be

$$\sum_{t} \left\{ \sum_{x} \left[n_x^t (1+\alpha)^{T-10} - n_x^t (1+\alpha)^{T-11} \right] E_i^t + \sum_{X} n_x^t (1+\alpha)^{T-11} E_c^t \right\}$$

$$= \sum_{t} \sum_{x} n_x^t (1+\alpha)^{T-11} \left[\alpha E_i^t + E_c^t \right]$$

where the summations $\sum_{t} \sum_{x}$ are to cover first all classes in the type t of education and then to cover all types of education.

The Stratigraphy of the Pre-Tertiary Sub-Surface Formations of Abu-Roash[1]

By

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I.—INTRODUCTION

The area of Abu-Roash lies near the edge of the Libyan Desert, ending at the Nile Valley cultivation at the village of Abu-Roash, 8 Kms. N.N.W. of the Giza pyramids and 15 Kms. west of Cairo.

The Standard Oil Company of Egypt drilled two wells and 6 core holes in Abu-Roash. Well No. 1 was drilled till the basement and was cored at very small intervals, particularly in the Cenomanian and Jurassic where coring was carried out nearly continuously. Well No. 2 was drilled till the Nubian sandstone only and was not as frequently cored as well No. 1. The present study was therefore concentrated on all the cores and some of the cuttings of well No. 1. The company supplied the writer with the washed residues of the cores and allowed him to study the original well samples. The lithology of the cores and cuttings was redescribed by Dr. S. W. Tromp and the writer, and on the basis of this description a well-log was prepared (chart II). This log is not hundred per cent reliable as there were only small amounts of the original samples left. The exact positions of the two wells are given in chart 1.

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(1) Communication présentée en séance du 7 février 1955.

II.—MACRO-STRATIGRAPHY OF THE PRE-TERTIARY SUB-SURFACE FORMATIONS OF ABU ROASH

The following description of the macro-stratigraphy of the Pre-Tertiary sub-surface formations of Abu-Roash is based only on the study of Abu-Roash well No. 1.

The well was drilled as seen from chart I in Wadi Talun, and according to the Standard Oil Company of Egypt, the Post-Mesozoic formations met with are Recent formations overlying Pliocene ones. The Recent formations are present in the well till a depth of 315 ft. (96 ms.) (see chart II). They are overlying probably Pliocene beds which occur till a depth of 530 ft. (161.5 ms.). The Pliocene is represented by shales, but as only poorly preserved cuttings (of the interval 504-530 ft.) were examnied, the exact nature of these beds could not be established. However, cuttings between 504 ft. and 530 ft. depth contained the following foraminifera : few small (usually less than 0.2 mm.) *Rotalia*, *Eponides*, *Bolivina*, *Buliminella* and fish teeth. The absence of *Globigerinidae*, *Globorotaliidae* and *Heterohelicidae*, which were found by the writer to be flooded in the Senonian surface formations of Abu-Roash, suggests that the above mentioned genera are not reworked Cretaceous foraminifera and represent Pliocene or younger fauna. The presence of these marine foraminifera indicates a marine origin of the Pliocene (or younger) beds at Abu-Roash.

It is well known that in the present Nile Valley from Beni-Suef southwards Pliocene conglomerates, sands and clays have been found containing corals, marine shells and sea-urchins indicating a sea arm which extended during Pliocene times up the Nile Valley (Ball, 1939). The presence of marine Pliocene in Abu-Roash is another support of this assumption.

The section between 530 ft. and 900 ft. depth (see chart II) is considered by the Standard Oil Company of Egypt as Cenomanian. However, in the writer's opinion a Turonian age seems more likely, considering the similarity between the Schlumberger potential and resistivity curves and the lithologic logs of both wells of Abu-Roash, of which well No. 2 started in the Turonian (see chart I). Also the similarity between the lithology of Abu-Roash and of other Cretaceous sections along the Gulf of Suez and in Sinai supports this viewpoint. The only difficulty in considering the part of the well between 530 ft. and 900 ft. as belonging to the Turonian is the presence of such a big section of shales. Such a section is not known to occur at the base of the Turonian in the surface section in the area. As this part of the well is not cored and the lithologic log is based only on study of poorly preserved cuttings, it is quite probable that these shales represent cavings from the overlying Pliocene shales. The presence of limestone at 530-633 ft. depth, which according to the Standard Oil Company of Egypt is containing flints, is another support for the Turonian age as no flint is found in the Cenomanian limestones on the surface.

From the base of the Turonian till the igneous basement the following lithologic units were distinguished :

Cenomanian.

Upper Sandy Series :

1) *Ferrugineous multicoloured sandstone- shale unit*. 900-1718 ft.)
2) *Limestone unit* (1718-1880 ft.)
3) *Glauconitic sandstone unit*. (1880-2031 ft.)

Lower Cretaceous :

4) *Middle Sandy Series*. (2031-2490 ft.)

Jurassic

Non-sandy Series :

5) *Shale and marl unit*. (2490-3480 ft.)
6) *Limestone and marl unit*. (3480-3982 ft.)
7) *Sandstone and marl unit*. (3982-4435 ft.)

Lower Sandy Series :

8) *Sandstone-shale unit*. (4435-5253 ft.)
9) *Pebbly sandstone unit*. (5253-6238 ft.)

These lithologic units can be characterised as follows :

CENOMANIAN (*Upper Sandy Series*)

1st. unit : *Ferrugineous multicoloured sandstone-shale unit* :

Alternation of ferruginnous sandstones and multicoloured shales with limestone intercalations. Limestones are in places rich in *Exogyras* and *Oysters*.

2nd. unit : *Limestone unit* :
This unit consists of glauconitic limestone with *Oysters*, with marl intercalations.

3rd. unit : *Glauconitic sandstone unit* :
Alternation of glaucnonitic sandstone and limestone with shale and marl intercalations.

LOWER CRETACEOUS. (*Middle Sandy Series*)

4th. unit :—*Middle sandy series* :
It consists of grey and white glauconitic sandstone with shale streaks.

JURASSIC. (*Non-Sandy Series*)

5th. unit :—*Shale and marl unit* :
Alternation of marl and shales, with limestone and very few sandstone intercalations.

6th. unit :—*Limestone and marl unit* :
Alternation of limestone and marl.

Lower Sandy Series

7th. unit :—*Sandstone and marl unit* :
Alternation of sandstone, marl and limestone.

8th unit :—*Sandstone shale unit* :
Alternation of sandstone and shale with limestoe intercalations.

9th unit :—*Pebbly sandstone unit* :
Sandstone with shale streaks, pebbly at the base.

It is worth mentioning that the afore mentioned three sandy series are also present in Gebel Maghara (N.E. Sinai) and thus serve for correlation purposes (see chart V).

III.—LABORATORY METHODS

The washed residues of the cores were prepared by the geologists of the Standard Oil Company of Egypt as follows : Any amount of the sample was taken depending on the amount of the washed residue left, but generally not less than 50 grams and not more than 200 grams were taken. If the sample was hard, it was crushed to fine powder. Soft samples and the crushed powder of hard ones were soaked in water for several hours and then the supernatant liquid was decanted. Soaking and decantation were repeated until the supernatant liquid remained clear. In case of very chalky samples, they were boiled with sodium carbonate. What was left of the core after these processes was kept in a separate bottle. When the writer was supplied with these bottles he passed the contents into a set of sieves with meshes 0.6 mm., 0.3 mm., 0.15 mm. and 0.075 mm. and two spreads of each of the resulting four residues on the picking instrument invented by W. Scheffen (1934) were examined and the microfaunal content picked and studied generically and quantitatively.

For the preparation of the quantitative generic microfaunal chart (chart III) the following graphic symbols were used : a dotted line for very rare (1-5), a dashed line for rare (6-10), a very thin line for common (11-100), a line 1 mm. in thickness for abundant (101-1000) and a line 2 mm. in thickness for flooded (more than one thousand).

IV.—MICRO-STRATIGRAPHY OF THE PRE-TERTIARY SUB-SURFACE FORMATIONS OF ABU-ROASH

The foraminifera were identified according to the latest classification of Cushman (1948). The micro-stratigraphical results achieved by Tromp (1939, 1941, and 1943) formed the basis for the establishment of the age boundaries between the different units.

A.—*Main Characteristics of Established Boundaries* :
Evidences for Lower Cenomanian :
The writer (1954), in his study of the micro-stratigraphy of the Upper Cretaceous formations of Abu-Roash, could distinguish

between an Upper Cenomanian and a Lower Cenomanian, the latter beginning from about 6 ms. above the base of the surface section and then forming the whole of the sub-surface Cenomanian section which occupies the interval between 900 ft. (274.3 ms.) and 2031 ft. (619 ms.). The main differences between Lower and Upper Cenomanian, as already given by the writer (1954), are as follows :

1. In the Upper Cenomanian the majority of the arenaceous foraminifera belong to the families *Trochamminidae* and *Lituolidae*, while in the Lower Cenomanian it is only the *Lituolidae* which is the most dominant arenaceous family, Trochamminidae being either rare or very rare.

2. Ostracods are better developed in Lower Cenomanian than in Upper Cenomanian.

3. Calcareous foramnifera, although on the whole very rare in the Cenomanian, occur, nevertheless, more frequently in the Upper Cenomanian.

Evidences for Lower Cretaceous :

The Cenomanian in Abu-Roash well No. 1 is underlain by a non-fossiliferous sandy section occurring between a depth of 2031 ft (619 ms.) and a depth of 2490 ft. (759 ms.). It is overlying a section which is considered to be of a Jurassis age as will be shown here under. Comparing the lithology of both Gebel Maghara and Abu-Roash sections, it is found that the aobve-mentioned non-fossiliferous sandy section corresponds to a similar section in Gebel Mahgara considered by Tromp as of Lower Cretaceous age as it underlies and overlies conformably definitely Cenomanian and Jurassic beds respectively. Also in other parts of Egypt (Sinai, Gulf of Suez) a similar lithologic developments of Lower Cretaceous age are found.

Evidence for Jurassic :

The Jurassic begins at 2490 ft. (759 ms.) and continues till the igneous basement. The evidences for assigning a Jurassic age to this part of the well are partly micropalaeontological and partly lithological :

i.—*Micropalaeontological Evidences* :

1. Absence of *Globigerinidae* (except 1 *Globigerinella* in core No. 70) and *Heterohelicidae* (except in cores Nos. 68 and 70) even in samples of favourable facies.

2. Sudden reappearance of *Lagenidae*, but all smaller than 0.2 mm.

3. Appearance of *Ammodiscus* and abundance of *Turritellella*.

4. Presence of *Discorbis* and *Eponides* smaller than 0.2 mm.

A point of interest regarding the microfauna of the Jurassic is the presence of minute *brachiopods* smaller than 0.2 mm.

ii.—*Lithological Evidence* :

Underlying core No. 93 is a very sandy section completely devoid of microfauna. Comparing the lithology of Gebel Maghara and Abu-Roash sections (see Charts II, III, IV, and V) the writer is rather inclined to believe that the lowermost section of the well is still of Jurassic age for the following reason :

The lowermost part of the Jurassic in Gebel Maghara is represented by a very sandy section which contains typical Jurassic macrofossils as *Rhynchonella*, *Terebratula*, etc. This very sandy section corresponds to the above mentioned very sandy non-fossiliferous section of Abu-Roash with the only difference that in the lowermost part of this very sandy section in Gebel Maghara there is a well developed calcareous section alternating with the sandy section, a similar alternation being absent in Abu-Roash, probably due to the more marine conditions that prevailed in the Gebel Maghara area. In Gebel Maghara, this very sandy section is considered by Tromp to be a Jurassic age, and there seems to be no reason why the corresponding very sandy section of Abu-Roash should not be consiered of a similar age.

B.—*Microfaunal Zones* :

A close study of chart III reveals the presence of a number of microfaunal zones, whose value for regional correlation work can not be asserted now in the absence of a series of studies of other cretaceous and Jurassic sections.

1. *Bathysiphon zone* :

This lies at a depth of 1007 ft. (307 ms.) (core No. 2), 107 ft. below the suggested Turonian-Cenomanian boundary. Except in this zone, the genus *Bathysiphon* is entirely absent from the whole chart except at a depth of 1372 ft 422 ms.) (core No. 13) where it occurs and is represented by a single individual. In this zone this genus has a common occurrence.

2. *Ostracod zone* :

This zone starts at 1007 ft. (307 ms.) (core No. 2) and ends at 1310 ft. (core No. 8), i.e., from 107 ft. below the suggested Turonian-Cenomanian boundary to 410 ft. below the same. Below this zone and except in two other cases, there is a sudden drop in the frequency of Ostracods to a very rare, rare, or common occurrence in contra-distinction to the abundant and flooded occurrence of Ostracods in the suggested zone. The above mentioned two exceptions occur at the depths 143 ft. (437 ms.) (core No. 18) and 1576 ft. (core480 ms). (core No. 29), where Ostracods have abundant and flooded occurrences respectively.

3. *Textularia-Anomalina zone* :

This zone occurs at a depth of 1746 ft. (532 ms.) (core No. 46), i.e., 846 ft. below the suggested Turonian-Cenomanian boundary, or 285 ft. above the cenomanian-Lower Cretaceous boundary. While the two genera *Textularia* and *Anomalina* have a common occurrence in this zone, they occur only very rarely in the few other cores in which they are met with.

4. *Upper Haplophragmoides zone* :

This zone occurs at a depth of 1888 ft. (576 ms.) (core No. 54), i.e., 143 ft. above the Cenomanian-Lower Cretaceous boundary.

5. *Lower Haplophragmoides zone* :

This zone occurs at a depth of 4069 ft. (1240 ms.) (core No. 87), i.e., 1579 ft. below the Lower Cretaceous-Jurassic boundary.

These two *Haplophragmoides* zones are named after the genus *Haplophragmoides*, which in places other than these two zones has a very rare, rare, common, or abundant occurrence, and which only in these two zones has a flooded occurrence.

6. *Turritellella zone* :

This zone lies below the Upper *Haplophragmoides* zone. It extends from a depth of 2756 ft. (843 ms.) (core No. 67) to a depth of 2979 ft. (908 ms.) (core No. 69) i.e., from 275 ft. to 489 ft. below the proposed Lower Cretaceous-Jurassic boundary. This zone is characterised by a common occurrence of the genus *Turritellella* which elsewhere occurs either very rarely or rarely.

7. *Ammodiscus zone* :

This zone lies below the *Turritellella* zone occurring at a depth of 3105 ft. (946.5 ms.) (core No. 80) or 615 ft. below the Lower Cretaceous-Jurassic boundary. The genus *Ammodiscus* occurs only three times throughout the whole sub-surface section and it is only in this zone that it has a common occurrence. In the other two cases it occurs only very rarely. Below this *Ammodiscus* zone follows the above mentioned Lower *Haplophragmoides* zone.

The afore mentioned zones are of a rather limited extent. A zone of a much wider extent is the *Lituolidae zone*, which starts from 6 ms. above the base of the surface Cenomanian section (the writer, 1954) and ends at the base of the Jurassic, running through the whole sub-surface section.

C.—*Comparison between the Jurassic of Abu-Roash and Gebel Maghara (N. E. Sinai)* :

The Jurassic section in Gebel Maghara is much richer in micro-faunal content than that in Abu-Roash (see charts III and IV).

1. *Arenaceous foraminifera* :

Certain families present in one section are absent in the other; e.g., the families *Astrorhizidae*, *Reophacidae*, *Valvulinidae* and *Verneuilinidae* present in Gebel Maghara are absent in Abu-Roash while the case is the reverse as regards the family *Ammodiscidae*. The families *Lituolidae* and *Textulariidae* are common to both localities.

In Gebel Maghara the family *Lituolidae* is represented by the genera *Ammobaculites* and *Haplophragmoides*, the latter genus dominating over the former one. In Abu-Roash, this family is represented also by the genera *Ammobaculites* and *Haplophragmoides*, and, in addition, by the genera *Trochamminoides* and *Ammomarginulina*.

In both sections the genus *Haplophragmoides* is the most dominant genus of the family *Lituolidae*. In Gebel Maghara the genus *Ammobaculites* occurs in one sample only where it has an abundant occurrence, while in Abu-Roash it occurs more frequently and has only a very rare, rare, or common occurrence. *Haplophragmoides* occurs much more abundantly in Abu-Roash than in Gebel Maghara.

The family *Textulariidae* has the same type of occurrence in both sections.

The family *Astrorhziidae* forms the greatest part of the arenaceous microfaunal content of the Jurassic in Gebel Maghara, the family *Lituolidae* coming next in order. In the Jurassic of Abu-Roash, the family *Lituolidae* is the most dominant arenaceous family and the whole microfaunal content is formed almost entirely by it.

2. *Calcareous foraminifera* :

a. *Imperforata* :

In Gebel Maghara, the Imperforata are represnted by the family *Ophthalmidiidae* and of this only the genus *Cornuspira* is present.

In Abu-Roash the Imperforata are represented only by the genus *Quinqueloculina* of the family Miliolidae.

Generally speaking, the Imperforata are of very rare occurrences in the Jurassic of both localities.

b. *Perforata* :

The families *Globigerinidae*, *Lagenidae*, and *Rotalliidae* are represented in both sections, but mainly as specimens smaller than 0.2 mm. (difference with younger sections).

Of the family *Lagenidae*, the genera *Dentalina*, *Frondicularia*, *Marginulina*, and *Vaginulina* are present in Gebel Maghara and absent in Abu-Roash. The genera common to both sections are *Lagena* *Lenticulina*, *Nodosaria*, *Planularia*, and *Robulus*. These genera except *Robulus*, occur very rarely in both sections, while *Robulus* sometimes has a rare occurrence. In Gebel Maghara, the genus

Robulus is the dominant genus of the family *Lagenidae*, while in Abu-Roash, the genus *Nodosaria* is the dominant genus. On the whole, the family *Lagenidae* is better developed in Gebel Maghara than in Abu-Roash.

The family *Rotaliidae* seems to be better distributed in Abu-Roash than in Gebel Maghara. Although in the latter locality the family is only represented once in the whole section (sample 321a) and only by the genus *Eponides*, yet this genus has an abundant occurrence, a similar occurrence being achieved neither by the genus *Eponides* nor by the genus *Discorbis* which occurs along with *Eponides* in Abu-Roash. In this section these two genera have only very rare occurrences.

The family *Polymorphinidae* is not present in Abu-Roash.

Anomalinidae, *Buliminidae*, and *Heterohelicidae* were not met with in the whole Jurassic section of Gebel Maghara. These families are represented by the genera *Anomalina*, *Bulimina*, and *Gumbelina* in the Jurassic of Abu-Roash. It is worth mentioning that the genus *Gumbelina* was never recorded before from Pre-Cretaceous sections in Egypt and Turkey.

3. *Non-foraminiferal micro-organisms* :

In both sections, the Jurassic is rather rich in its non-foraminiferal microfaunal content.

Tromp classified the Jurassic in Gebel Maghara into Upper-, Middle-, and Lower-Jurassic with question marks. This classification was based on lithology, macro- and micro-fossils. The boundary between Upper and Middle Jurassic lies between samples Nos. 418 and 345 and was based on the following :

1. Above sample No. 345, the section is richer in microfaunal content than the underlying section, many genera showing a sudden drop after this boundary, e.g., *Rhabdammina*, *Haplophragmoides* *Verneuilina*, Ostracods, and Echinoid spines.

2. This boundary coincides with a lithologic boundary, the underlying section being for the greater part marly while the overlying section being mainly composed of marly limetsone.

A similar boundary line between Upper and Middle Jurassic in Abu-Roash may be placed between *the shale and marl unit* and the *limestone and marl unit*, e.i., between cores Nos. 84 and 85, on a lithological basis only and not on a microfaunal one as there are no particular differences between the very poor microfaunal content of the samples above and below this boundary.

Tromp also determined the boundary between Middle and Lower Jurassic with regard to the fact that the section below sample No. 394 is poorer in its microfaunal content than the overlying section between samples Nos. 394 and 418. As is shown in chart IV there is a big section lying between samples Nos. 394 and 408. The boundary chosen by Tromp coincides with a lithologic boundary which is the top of the basal sandstone unit. A similar boundary may be drawn in Abu-Roash on microfaunal basis between corse Nos. 93 and 94 because the cores underlying core No. 93 are altogether unfossiliferous. This boundary line is preferably placed between the *sandstone-shale unit* and the *pebbly sandstone unit*.

ACKNOWLEDGEMENT

The writer wishes to thank Dr. S.W. Tromp for giving him the permission to publish charts IV and V of this work.

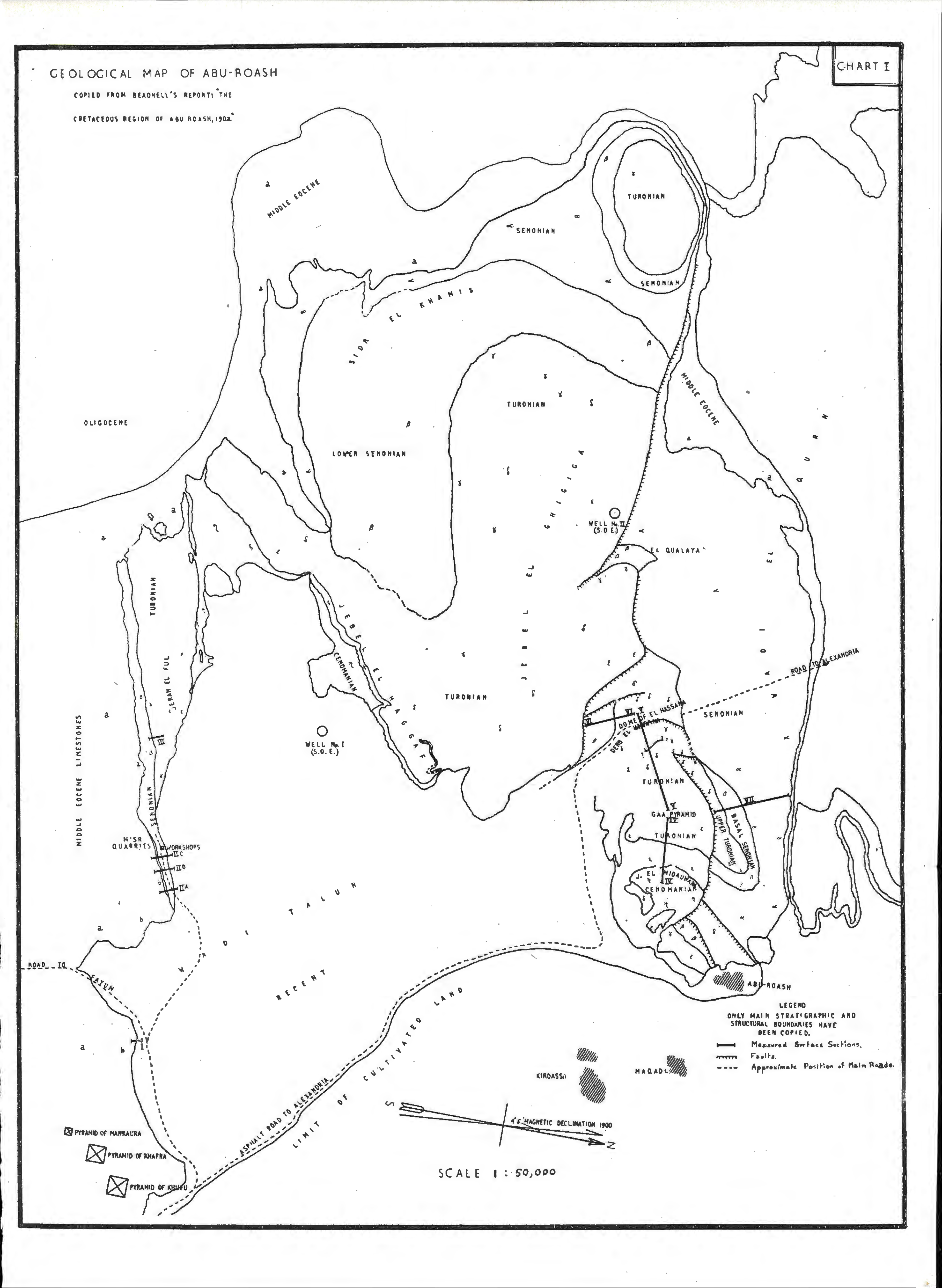
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1941, M.T.A. Bulletin, Ankara, Serie A, No. 4.
1943, M.T.A. Bulletin, Ankara, sene 8, sayi 1/29.



GEOLOGICAL MAP OF ABU-ROASH
COPIED FROM BEADNELL'S REPORT: "THE CRETACEOUS REGION OF ABU ROASH, 1902"
CHART I
MIDDLE EOCENE
SENOMIAN
TURONIAN
SENOMIAN
SIDR EL KHAMIS
OLIGOCENE
LOWER SENOMIAN
TURONIAN
JEBEL EL GHIGIGA
MIDDLE EOCENE
WADI EL QURN
WELL No. II (S.O.E.)
EL QUALAYA
TURONIAN
JERAN EL FUL
JEBEL EL HAGGAF
CENOMANIAN
TURONIAN
ROAD TO ALEXANDRIA
SENOMIAN
DOME OF EL HASSANA
DERB EL HASSANA
WELL No. I (S.O.E.)
MIDDLE EOCENE LIMESTONES
SENONIAN
TURONIAN
GAA PYRAMID
TURONIAN
UPPER TURONIAN
BASAL SENONIAN
J. EL MIDAUWARA
CENOMANIAN
MISR QUARRIES
WORKSHOPS
WADI TALUN
ROAD TO FAYUM
RECENT
ABU-ROASH
LIMIT OF CULTIVATED LAND
ASPHALT ROAD TO ALEXANDRIA
LEGEND
ONLY MAIN STRATIGRAPHIC AND STRUCTURAL BOUNDARIES HAVE BEEN COPIED.
Measured Surface Sections.
Faults.
Approximate Position of Main Roads.
KIRDASSA
MAQADL
4½° MAGNETIC DECLINATION 1900
S
N
PYRAMID OF MANKAURA
PYRAMID OF KHAFRA
PYRAMID OF KHUFU
SCALE 1 : 50,000

CHART II

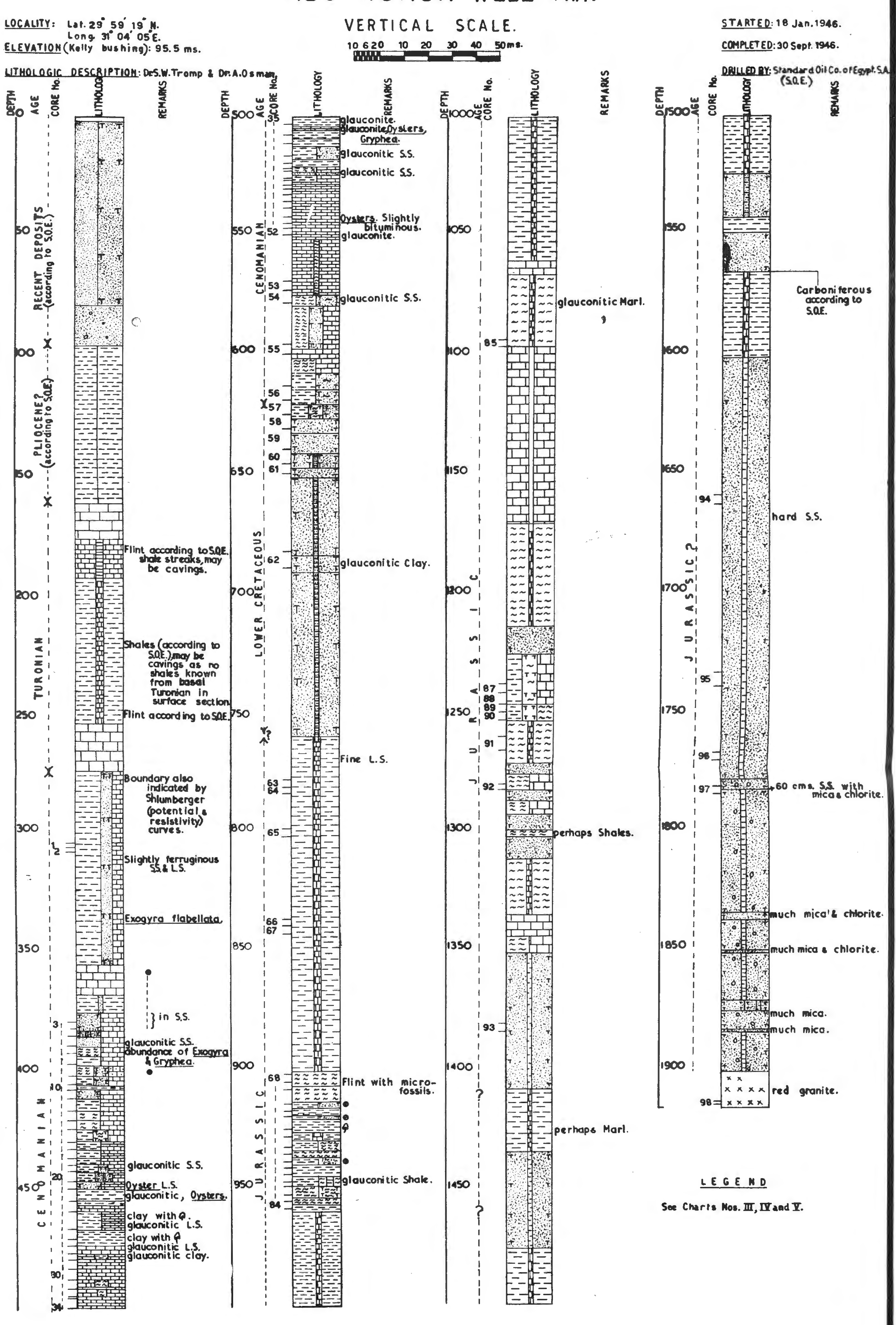
LITHOLOGIC SUB-SURFACE SECTION OF ABU-ROASH WELL No. 1.

LOCALITY: Lat. 29° 59' 19" N. Long. 31° 04' 05" E.
ELEVATION (Kelly bushing): 95.5 ms.

VERTICAL SCALE.

STARTED: 18 Jan. 1946.
COMPLETED: 30 Sept. 1946.
DRILLED BY: Standard Oil Co. of Egypt S.A. (S.O.E.)

LITHOLOGIC DESCRIPTION: Dr. S.W. Tromp & Dr. A. Osman.



LEGEND

See Charts Nos. III, IV and V.

QUANTITATIVE GENERIC MICRO-FAUNAL CHART.

OF

THE PRE-TURONIAN OF ABU ROASH

(SUB-SURFACE SECTION).

SAMPLE NUMBER

LOCALITY (SEE CHART No I).

STRATIGRAPHIC DISTANCE (SEE ALSO CHART No III).

LITHOLOGIC CHARACTERISTICS: LOCAL NAMES OF UNITS; COLOUR; LITHOLOGY

Samples 1–95: ABU-ROASH WELL No 1 (sample 1: TOP)

FORAMINIFERA

ARENACEA

- AMMODISCIDAE: AMMODISCUS, TURRITELLELLA
- LITUOLIDAE: AMMOBACULITES, AMMOMARGINULINA, CRIBROSTOMOIDES, FLABELLAMMINA, FRANKEINA, HAPLOPHRAGMOIDES, TRIPLASIA, TROCHAMMINOIDES
- RHIZAMMINIDAE: BATHISIPHON
- TEXTUARIIDAE: BIGENERINA, TEXTULARIA
- TROCHAMMINIDAE: TROCHAMMINA
- VALVULINIDAE: ARENOBULIMINA, CLAVULINA, DOROTHIA, MARSSONELLA, MARTINOTTIELLA, TEXTULARIELLA, VALVULINA
- VERNEUILINIDAE: PSEUDOGAUDRYINA, SIPHOGAUDRYINA, TRITAXIA, VERNEUILINA

CALCAREA

- MILIOLIDAE: PYRGO, QUINQUELOCULINA, SIGMOILINA, TRILOCULINA

PERFORATA

- ANOMALINIDAE: ANOMALINA, CIBICIDES
- BULIMINIDAE: BOLIVINA, BULIMINA, BULIMINELLA, REUSSELLA, TURRILINA
- CHILOSTOMELLIDAE: CHILOSTOMELLA, PULLENIA
- CYMBALOPORIDAE: CYMBALOPORA
- ELLIPSOIDINIDAE: ELLIPSONODOSARIA
- GLOBIGERINIDAE: GLOBIGERINA, GLOBIGERINELLA
- GLOBOROTALIIDAE: GLOBOROTALIA, GLOBOTRUNCANA
- HETERO-HELICIDAE: BOLIVINELLA, BOLIVINITA, BOLIVINOIDES, GUMBELINA, GUMBELITRIA, NODOGENERINA, PLANOGLOBULINA, PSEUDOTEXTULARIA, RECTOGUMBELINA, SIPHOGENERINOIDES, TUBITEXTULARIA, VENTILABRELLA
- LAGENIDAE: DENTALINA, PALMULA, FRONDICULARIA, LAGENA, LENTICULINA, LINGULINA, MARGINULINA, NODOSARIA, PLANULARIA, PSEUDOGLANDULINA, ROBULUS, VAGINULINA
- NONIONIDAE: NONION
- POLYMORPHINIDAE: PALAEOPOLYMORPHINA, PYRULINA
- ROTALIIDAE: DISCORBIS, EPISTOMINA, EPONIDES, GYROIDINA, ROTALIA, STENSIOINA

NON-FORAMINIFERAL MICRO-ORGANISMS

BRACHIOPODA, COPROLITE, ECHINOID SPINE, FISH TEETH, GASTEROPODA, OSTRACODA (ornamented), OSTRACODA (smooth)

MICRO-FAUNAL ZONES

Bathisiphon Zone; Ostracoda Zone; Gumbelina Zone; Textularia Zone; Upper Haplophragmoides Zone; Turritellella Zone; Ammodiscus Zone; Lower Haplophragmoides Zone; Lituolidae Zone

AGE

CENOMANIAN — UPPER CRETACEOUS — CRETACEOUS; LOWER CRET.; ? — JURASSIC

LEGEND

GRAPHIC SYMBOLS

Symbol	Abundance	Count
.....	VERY RARE	1–5
- - -	RARE	6–10
—	COMMON	11–100
— (thick)	ABUNDANT	101–1000
▬	FLOODED	> 1000

N.B. For correlation purposes some generic names are indicated as in chart II accompanying the writer's paper on the Micro-stratigraphy of the Upper Cretaceous Surface formations of Abu Roash (1955) although some genera are not present in sub-surface section.

LITHOLOGY

MARL (mr), MARLY LIMESTONE, CHALKY MARLY LIMESTONE, SANDY MARL, SHALE (sh), SANDY GYPSIFEROUS SHALE, SANDY SHALE, LIMESTONE (l.s), CHALKY LIMESTONE, CHALK, SANDY CHALK, SAND, SANDSTONE (s.s), ALTERNATION OF SANDSTONE & LIMESTONE, ALTERNATION OF SHALE, SANDSTONE & LIMESTONE

COLOURS

g	grey	gr	green	gl	glauconitic
whi	white	(cr)	creamish	m	massive
br	brown	(br)	brownish	l	light
cr	cream	yl	yellow		
d	dark				

MICRO-FAUNAE OF THE JURASSIC SECTION

IN

GEBEL MAGHARA (N.E. SINAI).

COMPILED BY

Dr. S. W. TROMP.

CHART IV

SAMPLE NUMBER	STRATIGRAPHIC DISTANCE IN METERS	LITHOLOGY	ARENACEA								CALCAREA													NON-FORAMINIFERAL MICRO-ORGANISMS						AGE
											Imperforata	PERFORATA																		
			ASTRORHIZIDAE		LITUOLIDAE		REOPHACIDAE	TEXTULARIIDAE	VALVULINIDAE	VERNEUILINIDAE	OPHTHALMIDIIDAE	GLOBIGERINIDAE	LAGENIDAE									POLYMORPHINIDAE	ROTALIIDAE							
			ASTRORHIZA	RHABDAMMINA	AMMOBACULITES	HAPLOPHRAGMOIDES	REOPHAX	TEXTULARIA	CLAVULINA	VERNEUILINA	CORNUSPIRA	GLOBIGERINA	DENTALINA	FRONDICULARIA	LAGENA	LENTICULINA	MARGINULINA	NODOSARIA	PLANULARIA	ROBULUS	VAGINULINA	EOGUTTULINA	EPONIDES	OSTRACODS	FISH-TEETH	SPONGE-SPICULES	ECHINOID-SPINES	CRINOID-REMAINS	GASTROPODS	
423	Top			1	104				1						1				5		?1			17			3		3	UPPER JURASSIC
421a	220 ms. b.s. 423										4	1	1			2	1	4	1	12		1	194	1	1		1		15	
419	15 ms. b.s. 421a		1	76		84				1												1		7			40		2	
418	8 ms. b.s. 419			264		254				21								3		3	1	2		21		7	67	3	2	?
345	21 ms. b.s. 418			3																				1			2		2	MIDDLE JURASSIC
346	5 ms. b.s. 345			8		2		?1									1	?3		1	?1			9			16			
347	1.5 ms. b.s. 346			10																										
348	11 ms. b.s. 347			6		3														4				23			3		24	
356	24 ms. b.s. 348			2																						1			3	
363	62 ms. b.s. 356			32										1				2						15		1	20		14	
364	13 ms. b.s. 363			24									9				3							122			19			
365	1.5 ms. b.s. 364			2																				1		3			17	
367	9 ms. b.s. 365																							1						
371	46 ms. b.s. 367			4																	1?			3			5		18	
372	5 ms. b.s. 371																							1					33	
373	12 ms. b.s. 372																							1					28	
376	27 ms. b.s. 373			1									1							1				9						
377	4 ms. b.s. 376			13												1				1				22		1				
378	4 ms. b.s. 377		1	109									1			2				?3				3		8			1	
379	15 ms. b.s. 378			45									4			4				6				2		7	7			
380	5 ms. b.s. 379																							1		3				
381	25 ms. b.s. 380			18																1									1	
382	3 ms. b.s. 381																												1	
386	32 ms. b.s. 382										1									1				1		1		1		
388	66 ms. b.s. 386			16									1							1				9				11	2	
390	24 ms. b.s. 388																												2	
391	2 ms. b.s. 390			13																		1					12			
393	25 ms. b.s. 391						?2									1		1		1	1			10	1	2	46		1	
394	27 ms. b.s. 393												9									2		18			6		146	?
408	190 ms. b.s. 394																							4			3			LOWER JURASSIC
409	5 ms. b.s. 408															2?				5				20			3			
412	12 ms. b.s. 409																							13					1	
414	15 ms. b.s. 412										1									6				13			1		16	
415	16 ms. b.s. 414																							5			11			

LEGEND.

Quantitative determinations by F. G. Engelberts; from a total of 98 samples (see Jurassic Correlation Chart) only 34 samples contain a micro-fauna.

GRAPHIC SYMBOLS.

..... VERY RARE 1–5
– – – RARE 6–10
—— COMMON 11–100
▬ ABUNDANT 101–1000
█ FLOODED > 1000

b.s. = below sample.

EXAMPLE.

(Total) 146 — 2 No. of forams present in sieve with mesh 0.5mm.
39 " " " " " " " " 0.3mm.
52 " " " " " " " " 0.2mm.
53 " " " " " " " " 0.999mm.

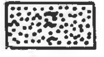
Quantities are based on two spreadings of 200 gms. rock (disintegrated), washed through sieves with meshes 0.6, 0.3, 0.2 and 0.999 mms.

LITHOLOGY.

MARL

MARLY LIMESTONE


SANDY MARL


CALCAREOUS SAND

TENTATIVE CORRELATION

BETWEEN THE JURASSIC SECTIONS
OF
GEBEL MAGHARA (N.E. SINAI), ABU-ROASH (W. OF CAIRO),
AND
KHASHM EL GALALA (GULF OF SUEZ).

COMPILED BY Dr. S.W. TROMP.

VERTICAL SCALE: 0 40 80 ms.

CHART V

KHASHM EL GALALA SECTION.	ABU-ROASH SECTION.	GEBEL MAGHARA SECTION.	AGE.
Measured by Dr. H. Sadek (1926).	(W. of Cairo) Surface Section measured by Dr. S.W. Tromp and Dr. A. Osman. Sub-surface section of Abu-Roash Well No. 1 (S.O.E.) described by Dr. S.W. Tromp and Dr. A. Osman.	(N.E. Sinai, 70 kms. W. of El Arish.) Section measured: E. of Shusht-el-Maghara, N.N.W. of Bir Umm Werib by Dr. S. W. Tromp.	

Abu-Roash section: Plicatula; Flint; Biradiolites; Nerinea; Acteonella; whi.; (gr.) g. (r.); Surface Section; Sub-surface Section; 1st. UNIT; Rich in Exogyra and Gryphea; g. or (gr.); glauc.; 2nd. UNIT Oysters; 3rd. UNIT g/lauc.; g. D (gr.); glauc.; g. (M.); g. (cl.); 4th. UNIT; g. and whi. glauc; Lithology uncertain; g. glauc.; 5th. UNIT; g. Flint; g. glauc.; shale or marl; glauconite; 6th. UNIT; d.g.; d.g.; 7th. UNIT; 8th. UNIT; whi.; whi. rich in mica.

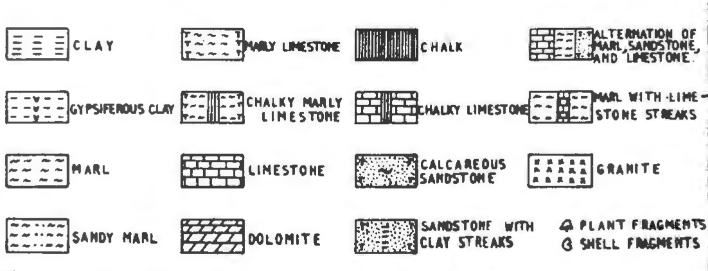
Khashm el Galala section: (gr.), br. & g. (M.) and purple S.S. Rhynchonella, Terebratula, Pholadomya; g. and br.

Gebel Maghara section: Field Number; d.g.; d.g.; br.; d.g.; whi. Flint.; ye. br.; whi. Rudists abundant.; CENTRAL FACIES; glauconitic S.S.; br. (r.) or purple. Strongly ferruginous.; 424, 423 g. br. (gr.) g. Flint. Corals.; 425 l.g. Ferruginous. corals.; l.g.; 422, 421 g. and ye. br. Rhynchonella. Echinoid fragments abundant.; g. (L.S.) and ye. br. (M.); 417, 344 much flint. Large Gastropods, Corals, Echinoids, Brachiopods.; g. (L.S.), (gr.) g. (M.) Rhynchonella.; l. 4m. Calc. br. b. Ferrug. S.S.; g. (L.S.) and ye. br. (M.) Rhynchonellas and Echinoids (Common).; 367 Clay bd.; 368 Clay bd.; d. br. ferruginous, crossbedded.; 375 Clay bd. L.S. bd. Wood Fragments Rhynchonella.; 376 Ferrug. S.S. bd.; S.S. bd.; Rhynchonella, Terebratula (abund.); Clay bd.; 385, 386 Rhynchonella, Echinoids.; 387 Algae nodules.; g. (L.S.); g. and br. (M.) Rhynchonella, Terebratula.; 392, 393 br. (S.S.), Ferrug. marly Corals and Echinoids.; 396, 397, 398, 399 Wood fragments.; 400 l. br. Ferrug. S.S.; 401, 402 g. (M.); 403, 404; 405 Plant fragments.; 406, 407, 408 g. Algae nodules.; l. Rhynchonella, Corals.; 415, 416 g (L.S.) and br Ferrug. S.S.; d.g. massive Algae nodules; 430, 429.

AGE: BASAL; MA. EST.; SANT. CAMPANIAN; SENONIAN; TURONIAN; CENOMANIAN; UPPER CRETACEOUS; LOWER CRET.; CRETACEOUS; MALM; ?; DOGGER; ?; LIASSIC; JURASSIC; MESOZOIC.

LEGEND.

1. Stratigraphic boundaries of G. Maghara section based on micro-fauna (see micro-faunal chart compiled by Dr. S.W. Tromp), lithology and macrofossils (section studied by Dr. S.W. Tromp in Feb. 1938.).
2. Stratigraphic boundaries of Abu-Roash section based on micro-fauna (see micro-faunal chart compiled by Dr. A. Osman), and lithology (see well log compiled by Dr. S.W. Tromp and Dr. A. Osman.).
3. Stratigraphic boundaries of Khashm-el-Galala section based on lithology and macro-fossils (indicating Dogger, according to Stefanini and H. Sadek); see "H. Sadek: The Geography and Geology of the district between G. Ataqa and El-Galala-El-Baharia. (Cairo, Survey Department, 1926.)".



l. = light. g. = grey. whi. = white (gr.) = greenish M. = marl. S.S. = Sandstone.
d. = dark. br. = brown. ye. = yellow. (r.) = reddish. cl. = clay. ● = Oil Show.
387 → 392 means samples No. 387, 388, 389, etc. .... till sample No. 392.

Electric Adsorption Isotherms

by

H. Löwy, Dr. Phil. (Göttingen)

and

H.A. Rizk, Ph. D. (Cairo.)

The possibility to determine the adsorption by measuring the dielectric constant results from the *theory of electrically conductive suspensions*. (Löwy 1934 - 1943), according to which the film volume V, that is, the volume which the adsorbed phase occupies in unit volume of the substance is

(1) $$V = M + P - 1$$

P is the porosity of the substance,

M the *electrodynamic volume* which, according to its definition (Löwy 1938), is proportional to the electric moment in unit volume of the substance, situated in an electric field of unit intensity. If the particles of the substance are spherical, the electrodynamic volume reduces to the well-known expression of *Clausius* and *Mossotti*.

(2) $$M = (\varepsilon - 1) / (\varepsilon + 2),$$

in which ε is the dielectric constant of the substance.

In our experiments, the adsorbent was used as dielectric of a condenser, situated in a hermetically closed chamber in which the adsorbent was exposed to known constant pressures of water vapour at (nearly) constant temperature.

For producing the different vapour pressures, we have used the saturated salt solutions, indicated in Table I (Knowles and Spilhans 1953).

TABLE I.

Temp.	*Relative Pressure of Water Vapour*				
	KNO_3	NaCl	$M_g(NO_3)_2$	Mg Cl_2	Li Cl
Cels	p.c.	p.c.	p.c.	p.c.	p.c.
0	97	76	54	34	19
10	95	75	53	33	14
20	94	75	53	33	12
30	92	75	52	32	11
40	89	75	51	31	11

We have used clay powder as adsorbent. Its dielectric constant has been measured at 1 Mc/sec by means of the *Slevogt Dekamete* (condenser MFL 1). We repeated the measurement until a constant value has been attained, that is, until evaporation equilibrium at the surface of the salt solution and adorption equilibrium at the surface of the adsorbent has been established.

In Table II are indicated, for two different clay powders, the equilibrium values of the dielectric constant and the corresponding relative pressures p/p_o of water vapour at 20° Celsius. The real temperatures have been somewhat higher.

TABLE II.

p/p_o	*The first isotherm*		*The second isotherm*	
	ε	$(\varepsilon-1)/(\varepsilon+2)$	ε	$(\varepsilon-1)/(\varepsilon+2)$
0.12	2.05	0.26	3.75	0.48
0.33	2.15	0.27	5.05	0.57
0.53	2.50	0.33	5.10	0.58
0.75	4.05	0.50	5.55	0.60
0.94	10.50	0.76	8.30	0.71

In the graphical representation (fig. 1 and 2), we have used $(\varepsilon-1)/(\varepsilon+2)$ as ordinate, instead of V. By this, however, the form of the curve is *not* changed since P is constant. The form of the electric adsorption isotherms is consistent with the fact that multimolecular adsorption usually leads to this form of the curve (*de Boer* 1953, p. 219) and the fact that adsorption below the critical temperature is multimolecular (*Brunauer* 1945, p. 366).

In fig. 1, the dielectric constant, corresponding to the horizontal part of the curve is $\varepsilon = 2$. This value being the lower limit of the range of the Slevogt Dekameter, the part of the curve which, is concave to the p/p_o. — axis, could not be measured. Fig. 2, concerning a sieved clay powder of grain diameters between 0.3 and 0.5 mm, represents a complete S — shaped isotherm.

In our experiments, the clay is exposed to a mixture of gases (the air) from which the water vapour is adsorbed. According to *Brunauer* (1945, p. 474), "the study of *mixed adsorption* is of tremendous practical importance", since "most of the technical applications of adsorption processes involve gas mixtures rather than one gas alone".

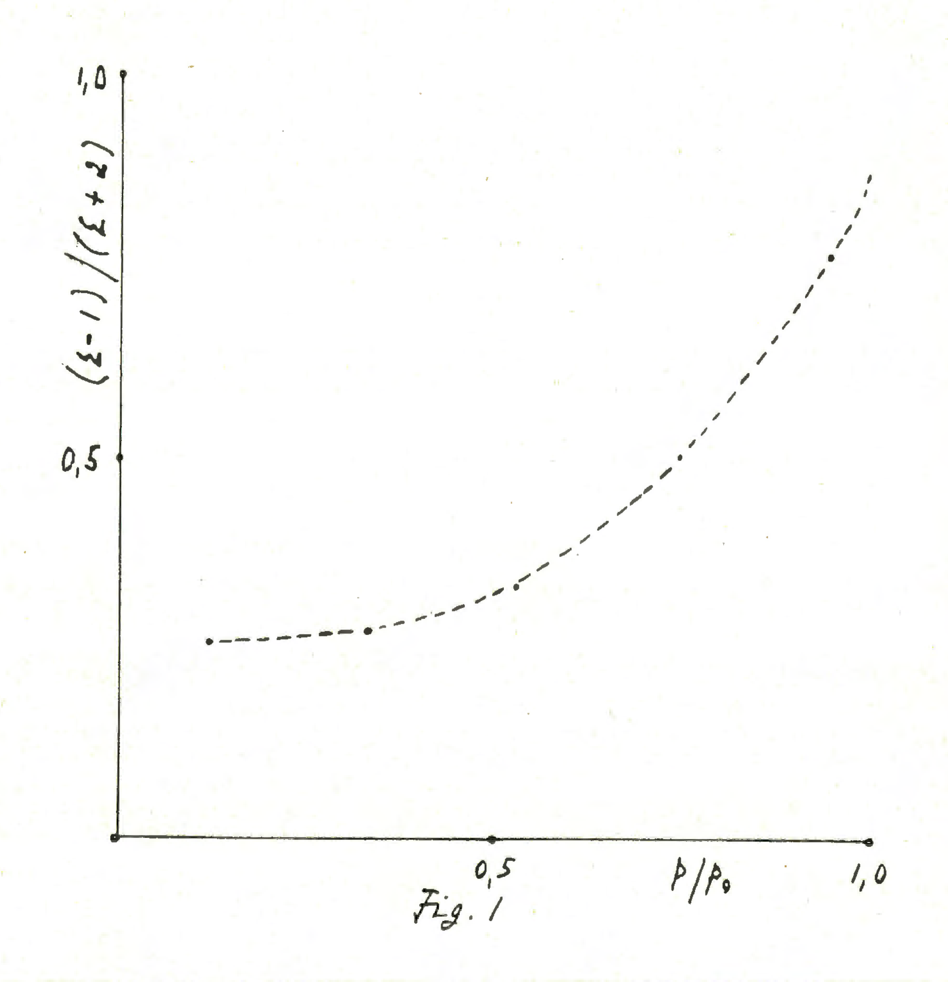
A practically important problem of mixed adsorption which, however, can not be treated by means of the usual methods is the determination of the conditions under which desert soils are transparent to electric waves. The problem is fundamental in the electrodynamic ground-water prospection of deserts, and can be solved by means of electric adsorption isotherms.

Further tests of the new method are in preparation.

We wish to express our thanks to *Professor Dr. A. Tourky* for placing at our disposal the resources of the Department of Physical Chemistry, Cairo University.

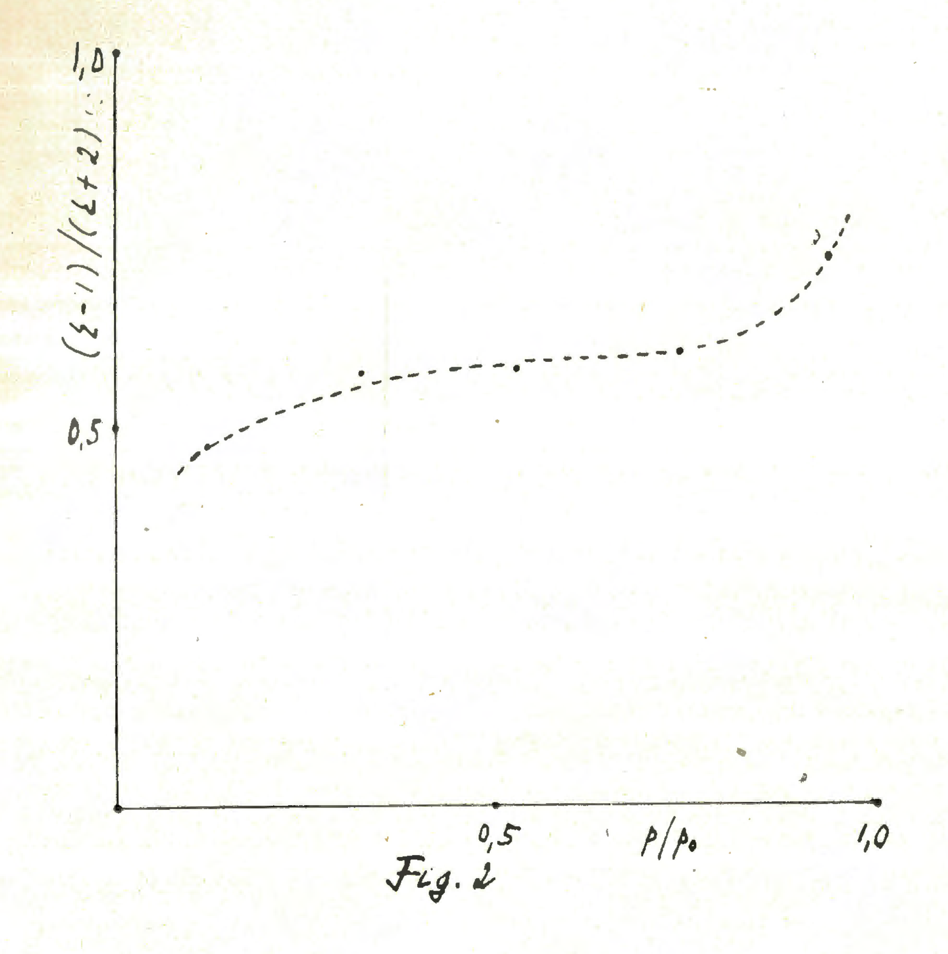
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1,0
0,5
$(\varepsilon-1)/(\varepsilon+2)$
0,5
p/p_0
1,0

Fig. 1



1,0
0,5
$(\varepsilon-1)/(\varepsilon+2)$
0,5
p/p_0
1,0

Fig. 2

On Electrically Conductive Suspensions

by

H. Löwy, Dr. phil. (Göttingen)

In the paper "Electrodynamic hydrology" (Löwy 1940) I have discussed different applications of the *general equations of electrically conductive suspensions* (Löwy 1938). In the following some other applications of these equations are discussed.

I. DENSITY DISTRIBUTION IN THE ADSORBED PHASE

Let us consider two adsorption equilibria, corresponding to two different relative pressures (p/p_o) of water vapour.

The porosity P being constant, the corresponding variation of the adsorption space v_a (in unit volume of the substance) is determined by the corresponding variation of the dielectric constant ε, as follows :

$$(1) \quad \Delta v_a = \Delta\left(\frac{\varepsilon - 1}{\varepsilon + 2}\right)$$

If we measure, by means of a balance, the corresponding variation of weight ΔW of the substance, whose volume v is known, we obtain *the density d of the filmlayer, which has been produced by increase of vapour pressure* :

$$(2) \quad d = \frac{\Delta W}{v} \Big/ \Delta\left(\frac{\varepsilon - 1}{\varepsilon + 2}\right)$$

Repeating this measurement for a series of increasing values of vapour pressure, we obtain the density distribution in the adsorbed phase.

II. SURFACE AREA OF ADSORBENTS

We suppose that the value of the dielectric constant ($\varepsilon = \varepsilon_o$) corresponding to the horizontal part of the electric adsorption isotherm, indicates the monomolecular layer. This supposition is compatible with the supposition of *Bruhauer* and *Emmett* (1937) who consider 'the beginning of the straight line portion as the most likely point to correspond to a monolayer".

Designating with r the radius of the water molecules, with P the porosity, we obtain the surface area A in unit volume of the adsorbent from the relation.

$$(3) \quad 2rA = \frac{\varepsilon_o - 1}{\varepsilon_o + 2} + P - 1$$

III. ELECTRIC DETERMINATION OF POROSITY

At zero pressure of water vapour the electrically conductive water-film suspensions transform into dielectric mixtures and the equations of conductive suspensions reduce to *H.A. Lorentz*' (1909) equations of dielectric mixtures. In the case of a mixture of rock particles (ε_1) and air, these equations reduce to

$$(4) \quad \frac{\varepsilon - 1}{\varepsilon + 2} = \frac{\varepsilon_1 - 1}{\varepsilon_1 + 2}(1 - P)$$

and we obtain

$$(5) \quad P = 1 - \frac{\varepsilon - 1}{\varepsilon + 2} \bigg/ \frac{\varepsilon_1 - 1}{\varepsilon_1 + 2}$$

ε and ε_1, are the dielectric constants of the mixture and its solid component, respectively.

IV. REDUCTION OF METAL OXIDES AND TWO OTHER PROBLEMS

According to *Mott* and *Gurney* (1948), the reduction of metal oxides consists in the formation of metallic nuclei, that is, in the transformation of an insulator (the metal oxide) into a metallic suspension. In my first paper, concerning the theory of suspensions, I have indicated a simple formula (*Lôwy* 1934).

$$(6) \quad V = \left(\frac{\varepsilon - 1}{\varepsilon + 2} - \frac{\varepsilon_1 - 1}{\varepsilon_1 + 2}\right) \bigg/ \left(1 - \frac{\varepsilon_1 - 1}{\varepsilon_1 + 2}\right)$$

which could be used for determining the total volume v_c of the electrically conductive nuclei, dispersed in unit volume of the oxide, by measuring the dielectric constants of the suspension ε and of the metal oxide ε_1. For spherical nuclei :

$$(7) \quad v_c = V.$$

By means of this method, one could observe the growth of the nuclei, without interrupting the process for measuring purposes.

The same formula (6) could be applied to the study of metallic azides. In this case, metalic nuclei are formed during the decomposition. (*Garner* and *Maggs* 1939, *Mott* 1939, *Wischin* 1939).

Another system, to which formula (6) may prove to be applicable is the *plant cell* in which, acc. to *Maximov* (1930), the water is not a continuous, hut a dispersed phase. This opinion is supported by some preliminary measurements of the dielectric constant ε and resistivety ρ of rose leafs and rose stems : I found the values : $\varepsilon = 1{,}1$ and $\rho = 3.10^8\ \Omega$ cms.

V. PHASE REVERSAL OF EMULSIONS AND DENATURATION OF PROTEINS

We now consider cases in which relation (7) is *not* valid and, in which changes in the form of the dispersed particles are revealed by corresponding changes of the dielectric constant.

Clowes (1916) has shown that emulsions of oil, dispersed in water, can be converted into emulsions of water, dispersed in oil, by shaking with salts of Ca, Mg., Fe; and that the inverse transformation can be obtained by shaking with NaOH or other alkali. According to Clowes, his experiments afford an explanation of the data, accumulated by *Jacques Loeb* (1906) and other biologists, concerning the action of antagonistic electrolytes in emulsions and living cells.

At the beginning, when spherical water particles are dispersed in the oil, the dielectric constant of the emulsion is determined by formula (7). Geometrically, the phase, reversal consists in a deformation of the spherical water particles. This deformation, at constant concentration of the water particles, produces a change of the dielectric

constant and finally, transforms an insulating substance into a conductor.

I mention another case in which deviations from formula (7) may be of biological interest. From his viscosity researches, *H Staudinger* (1954) has deduced the result that spheromolecular sub stances are *not* subject to *ageing phenomena*, in contrast to linear molecular substances. The fact that spheroproteins are subject to *denaturation* is *not* in contradiction to Staudinger's result, since denaturation consists in unfolding of the rigid structure of the sphero-proteins, that is, in transformation of spherical into linear macromolecules. Formula (7), therefore, may prove to be useful as electric indicator of ageing.

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An Anatomical Study of some "Sedges" in Relation to Plant Remains of Ancient Egypt

By

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INTRODUCTION

The relatively clear picture that was brought to us about the former Ancient Egyptian life was actually the result of a comprehensive study carried out by several workers in different fields. The presence of tremendous amounts of ancient remains is probably the most important factor that facilitated such study. From the botanical science point of view, the discovery of these remains can undoubtedly bring to light valuable information about the former Egyptian plants prevailing at these remote periods. In many of the studies carried out on these plants, the latter were referred to as halfa grasses, palms, sedges, reeds, rushes, etc. This vague identification was mainly based on morphological characters. The need for a more reliable method for identification of ancient plant materials, specially where these are available only in minute remnants or parts of obscure morphological characters, has been realised by many botanists dealing with the subject. This led to the use of detailed anatomical features as a basis for a more sound identification.

Schweinfurth was probably the first to draw attention towards the use of the anatomical features for the precise identification of the ancient plant remains. The idea has been expanded and elaborated in such monumental works as those of Solereder (1908), Solereder and Meyer (1928-1933) and Metcalfe and Chalk (1950).

The present work is only devoted for the study of "Sedges". This group of plants includes the *Cyperus species*. In the present paper, 4 *Cyperus* species are studied, namely, *Cyperus Papyrus*, *C. rotundus*, *C. Schimperianus*. and *C. alopecuroides*. *C. Papyrus* is closely attached to the history of Ancient Egyptians and proved to be one of the commonest tomb plants. *C. rotundus* and *C. alopecuroides* were mentioned by many authors among the various Ancient Egyptian plants e.g. Schweinfurth, 1886; Loret, 1892; Joret, 1897, Woenig, 1897; and Keimer, 1927. *C. Schimperianus* was identified in the present study in one of the specimens examined.

Modern specimens were brought from different localities of the country, while ancient materials were brought from El-Omari Excavation, Helwan Excavation, Egyptian Museum, Stockholm, Agricultural Museum, Cairo, and the Egyptian Museum of Antiquities, Cairo.

The anatomy of the different parts of the 4 *Cyperus* species using modern specimens was thoroughly studied. Standard slides of the epidermal strips and transverse sections were prepared to show the anatomical structure of the various organs of every species. In case of ancient material to be identified, it was soaked in tepid water until the tissues were so soft that sections could be cut, or epidermal strips could be peeled and made thin by scraping. Brittle ancient materials were soaked in a mixture of alcohol and glycerine, dehydrated, embedded in wax and then cross sections were procured.

A. CYPERUS PAPYRUS' L.

I. — Morphological Description.

Cyperus Papyrus is a perennial sedge that grows in fresh water swamps. The rhizomes grow into interwoven masses (tussocks) giving rise to groups of culms. The culm is stout, smooth, trigonous, leafless with several empty sheats at the base. It reaches 4 to 5 m. in height. (Fig. 1). The culm is terminated by the inflorescence

consisting of an umbel of branches known as umbel rays. Each umbel ray is surrounded at the base by a cylindrical trigonous bracteole ensheating its base.

The umbel ray is triangular is cross section and is terminated by 3 to 5 linear green foliaceous bracteoles. It also carries a spike of spikelets. The whole umbel is surrounded at the base by a whorl of broad papery bracts. (Fig. 2).

II ANATOMY.

1.—Root.

In transverse section, the root is bounded by a single layered exodermis followed by 2 to 5 layers of thick-walled suberised cells. The outer region of the cortex is formed of radial rows of thin-walled parenchyma cells, which, in older roots, become six-armed stellate cells with large intercellular spaces. The inner region consists of 4 to 5 layers of cells with round corners and small intercellular spaces. Then follows the endodermis formed of rectangular cells whose walls become thickened except for the passage cells.

The pericycle is formed of one layer of thin-walled cells. The vascular elements are arranged in the usual way of a monocot root. The pith is composed of compact thick-walled parenchyma cells.

2.—Culm.

a) Epidermis in Surface View :

The epidermis at different levels of the culm, shows variation in structure and cell arrangement.

Close to rhizome where the culm is covered by empty sheaths, the epidermal cells are all similar being thin-walled and arranged in parallel rows.

Higher up in the basal region of the culm, the epidermal layer is formed of two parallel bands of cells : (1) wide bands composed of elongated rectangular thin-walled cells with straight walls, (2) narrow bands of elongated polygonal thick-walled cells with densely pitted walls. No stomata are found in this region.

Higher above the base of the culm, the epidermis is formed of parallel bands : (1) narrow bands formed of elongated cells with

straight thin walls; and (2) broader bands of large polygonal or elongated thick-walled densely pitted cells. Stomata are lacking or rare in this region of the culm and when present are within the broader bands.

In the upper part of the culm, all the epidermal cells are thick-walled and pitted, but the stomata (of the grass type) are confined to the broad bands (Fig. 3 A modern; Fig. 3 B ancient).

The stomata are generally found in single rows. The subsidiary cells of the stomata are narrow and elongated with thickened outer walls.

In the uppermost part of the culm, the epidermis is made up of parallel bands of homogeneously and moderately thickened cells. The bands are however differentiated by the presence of stomata in one of the two alternating bands only.

b) Transverse Section. (Fig. 4 A modern; Fig. 4 B ancient).

The culm is triangular in outline, a characteristic feature of the family.
The epidermis is formed of ordinary thick-walled epidermal cells, sometimes radially elongated, intercalated by stomata. Below the stomata are found patches of chlorenchyma tissue alternating with strands of fibres.

The ground tissue is differentiated into a narrow peripheral zone and a large inner one. The narrow zone is formed of several layers of radially elongated chlorenchyma cells. This assimilatory region is intercalated by 3 kinds of vacular bundles. (1) The majority are small reduced bundles of the third order lying in the peripheral region. The others are larger collateral ones of the fi-st and second orders. Each bundle, has a sheath of a single layer of narrow cells. Each one of the collateral bundles has, in addition, an inner patch of fibres that form with a hypodermal fibrous patch a well developed I-girder. The phloem tissue is surrounded by large cells filled with

(1) Pee-Laby 1898, classified the vascular bundles into 5 orders. The first order comprises those with distinct protoxylem and metaxylem vessels and group of phloem ; the second order is similar to the first except that the protoxylem is absent. The third has neither metaxylem nor protoxylem, but a number of lignified elements, the fourth order resembles the third but has fewer lignified cells and the fifth has no lignified tissue. For convenience 4 orders are considered. The third and fourth orders are referred to, as belonging to the third.

chloroplasts. The xylem of the larger bundles is capped by a sclerenchyma sheath of 2 to 3 cells in thickness.

The large inner zone of the ground tissue is made up of highly lacunate aërenchyma with 3-armed cells, containing rod-like crystals of calcium oxalate. These lacunae are formed schizogenously. This confirms previous observations by De Bary (1884). In the inner zone there are also scattered vascular bundles of various sizes with or without protoxylem cavity. Each of these bundles is surrounded by a sheath of thick-walled lignified cells.

A more or less similar description of the culm was given by Weisner (1927-1928), but he did not refer to the three-armed cells. However, it is worthy to note here, that in the present work, the presence of the 3-armed cells in *Cyperus Papyrus* culm was one of the characters that made differentiation of *Cyperus* species possible.

3.—Umbel Rays.

The umbel ray is very small in size compared with the culm. In transverse section, the structure of the umbel ray does not differ much from that of the culm, except that the aërenchyma is greatly reduced. The outer region is formed of assimilatory tissue in which are embedded a number of reduced bundles. The inner region is made up of thin-walled parenchyma with large intercellular spaces and enclose a ring of large and small collateral bundles.

4.—Bracts.

The bracts supporting the inflorescence are brownish green and become dry and papery with age. In length they vary from 6 to 10 cms. They have a midrib and parallel venation.

i. Lower Epidermis in Surface View.

The lower epidermis is formed of bands of narrow elongated cells with thin straight umpitted walls alternating with bands of large rectangular cells of various sizes with thick rippled and densely-pitted walls.

Stomata of the grass type are found among the large rectangular cells. Aiguillons are common among the bands of narrow elongated cells.

ii. Upper Epidermis in Surface View.

The epidermis is striated by bands formed of rectangular cells with straight unpitted walls alternating with narrow bands formed of longer epidermal cells. These narrow bands cover hypodermal groups of fibres.

The epidermal cells of the leaf margin are more compact with thicker and pitted walls.

Stomata are absent from this upper surface of the leaf except in a narrow peripheral strip. Aiguillons" are mainly present on the leaf margins.

iii. Transverse Section (Middle Region) (Fig. 5).

The bract is V-shaped in transverse section. The upper epidermis consists of broad strips of large cells alternating with narrow strips of smaller cells. All the cells are thin-walled but while the broad strips are followed by a single layer of thin-walled hypodermis, the narrow strip are underlined by patches of lignified fibres. The epidermal cells at the junction of the two arms are radially elongated. Few "aiguillons" are present. Some of the epidermal cells enclose short pyramidal crystals. Stomata are absent.

Two types of vascular bundles are present : small reduced bundles formed of phloem only and large bundles of the first order. Most of the bundles form the webs of I-girders. The upper and lower flanges of the I-girders are represented by small patches of subepidermal fibres and connected with the bundles by parenchyma cells. Each bundle is surrounded by a thick-walled endodermal sheath.

The remaining part of the ground tissue is composed of parenchyma cells of 3 types :

1. Round cells, some containing tannin, found above the reduced bundles and above and below the collateral bundles.

2. Stellate aërenchyma cells with 5 to 8 arms each occupying the space between the large collateral vascular bundles.

3. Elongated chlorenchyma cells radiating around the vascular bundles.

The cells of the lower epidermis are smaller in size than those of the upper epidermis and are intercalated by stomata of the grass type.

5.—Bracteoles. (Fig. 6)

The cross section of the linear green foliaceous bracteole is V-shaped. The upper epidermis is devoid of stomata, while the cells of the lower epidermis are smaller in size and enclose gramineaeous stomata.

The vascular bundles are also of 3 types : Few bundles (generally three) of the first order, few bundles of the second order, and many reduced bundles of the third order. The bundles of the first order are regularly distributed in the mesophyll. The upper part of the mesophyll tissue is formed of colourless parenchyma cells intercalated by sub epidermal patches of fibres. On the lower sides, there is an intermittent hypodermal layer formed of a single layer of colourless parenchyma cells intercalated with small patches of fibres. The chlorenchyma tissue constitutes the remaining part of the mesophyll and surrounds the vascular bundles.

Some of the upper and lower patches of fibres form with the large collateral bundles simple I-girders.

A description of the structure of the bracteoles of *Cyperus Papyrus* was reported by Tadros (1940) and it is quite concordant with the description given above.

B. CYPERUS ROTONDUS, L.

I. — Morphological Description.

Cyperus rotundus is a sedge with creeping rhizomes and thin erect culms that grow up to 30 cms high. It is commonly found as a weed along roads and in sandly places. The long stolon is thin and produces black ellipsoid or spindle shaped tubers. These small aromatic tubers are said to be of medicinal value : stomachic, emmenagogue, diaphoretic, diuretic, astringent, etc.

II ANATOMY

1.—Root.

In transverse section, the root is outlined by a piliferous layer. The cortex is aërenchymatous and composed of several layers of

round thin-walled parenchyma cells alternating with tangentially elongated cells. The cells of the innermost layers are arranged in radial rows. The endodermis has thickened radial walls and is followed by a thin walled periyclic layer.

The central cylinder is rather small in size. The vascular strands of xylem and phloem are numerous. The metaxylem vessels are few in number. The pith is thick-walled and lignified.

2.—CULM.

a) Epidermis in Surface View (Fig. 7).

The epidermis is a made up of narrow bands of narrow elongated rectangular cells with pitted and finely rippled walls, alternating with broad bands of larger cells, with slightly rippled and less pitted walls. Stomata of the grass type are found in the broad bands in one or two rows. The subsidiary cells are wing-like, shorter and broader than the guard cells.

b) Transverse Section (Middle Region) (Fig. 8).

In cross section the culm is triangular with rounded corners, a characteristic feature of the Cyperacea. The epidermal cells are uniform in size and shape. The outermost region of the ground tissue is formed of alternating patches of fibres and thin-walled parenchyma cells. Solitary short pyramidal crystals are found adhering to the inner walls of some of the epidermal cells which lie above the patches of fibres. The remaining part of the ground tissue is formed of polygonal thin-walled parenchyma cells, some of which contain tannin. These parenchyma cells enclose wide intercellular spaces. The vascular bundles are scattered in the gound tissue. The peripheral bundles are small and of the second and third orders. Each one of these bundles is surrounded by a sheath of thin-walled parenchyma layer. The remaining bundles are of the first order, large and have well developed phloem and xylem elements with large protoxylem canals. Each bundle is surrounded by an endodermal layer with thickened inner and radial walls. In addition, there is a cap of lignified cells around the xylem.

3. LEAF.

a) Lower Epidermis in Surface View.

The epidermis is differentiated into alternating wide and narrow bands. The differentiation is actually based on the arrangement of the stomata being only confined to regions above the assimilatory tissues; the alternating bands can hardly be differentiated by cell structure only. The stomata are relatively more frequent than in the culm.

b) Upper Epidermis in Surface View.

The upper epidermis is similar in structure to the lower epidermis except in the fact that stomata are absent.

c) Transverse Section (Middle Region). (Fig. 9).

The upper epidermis is made up of large rectangular cells with their long axis perpendicular to the surface of the leaf and occupying almost the third of the thickness of the leaf blade. At intervals the epidermal cells are small and are subtended by a small patch of narrow fibres. The epidermis in the vicinity of these patches, becomes enlarged in such a way, that the thickness of the fibres and the surrounding epidermal cells is almost the same, as that of the large epidermal cells.

In the narrow epidermal cells, above the fibres, are embedded solitary short pyramidal crystals similar to those found in the culm epidermis.

The vascular bundles, similar to those of *C. Papyrus* bract: are formed of 2 types : few large collateral bundles and many small reduced ones, regularly distributed in the leaf blade. Each bundle is surrounded by a single endodermal layer of thin-walled cells. Inner to the endodermal layer, the xylem and phloem are surrounded by large round cells containing chloroplasts.

The green assimilating tissue is radiating around the vascular bundles, occupying almost the whole mesophyll tissue except for some hypodermal patches of fibres on the lower side of the leaf. These patches, together with some parenchyma cells form with the large

bundles, simple I-girders. The reduced bundles are also connected to the lower epidermis by patches of thin-walled parenchyma cells.

Within the mesophyll tissue in the median region of the two arms of the blade are found patches of aërenchyma cells generally below the reduced bundles and between the collateral ones.

The lower epidermis of the leaf is formed of round cells much smaller than those of the upper epidermis. The epidermal cells that adjoin the patches of fibres show the characteristic crystals seen in the upper epidermis.

Stomata are confined to the lower epidermis.

C. CYPERUS SCHIMPERIANUS, STEUD.

I.—Morphological Description.

C. Schimperianus has creeping rhizomes that are woody. The culm, which grows up to about 90 cms. high is surrounded by long reddish sheaths. The two uppermost sheaths have short leaf blades. The plant grows along canal banks and in moist places. The stems were used in Ancient Egypt in mat — and basket — making.

II. — ANATOMY

1. Root.

In transverse section, the root is outlined by a few layers of suberised thin-walled cells. Then follows a zone of tangentially elongated thin-walled cells enclosing among them some rounded cells.

The inner cortex is made up of 4 to 5 layers of thick-walled suberised cells. The endodermis is formed of lignified cells, with the 4 walls thickened.

The pericycle, one or two layers, is formed of thin-walled cells. The vascular bundles are few in number with very large metaxylem vessels occupying the major part of the central cylinder.

The pith is thick-walled and lignified. Tannin cells are scattered in the central cylinder.

2. Culm.

a) Epidermis in Surface View. (Fig. 10).

The epidermis is formed of parallel bands of more or less the same structure as that of *C. rotundus* except for the less marked rippling of the epidermal walls. The stomata are of the gramineous type and have thin guard and subsidiary cells almost of the same length.

b) Transverse Section (Fig. 11).

It is to be noticed here that the culm is round in cross section in the very top and hardly round trigonous in other parts.

The epidermal cells have a thick cutinised outer wall and a thin cuticle. They are intercalated at frequent intervals by the stomata.

Below the epidermis are found large and small patches of lignified fibres, alternating with large thin-walled parenchyma cells adjoining the stomata.

The vascular bundles are more crowded at the periphery where 2 types can be recognised : (1) Small round vascular bundles of the third order (2) Larger vascular bundles of the second order. While the small bundle is surrounded by a layer of large thin-walled cells ensheathed by another layer of much smaller thick-walled cells, the large bundle is surrounded by a thick-walled endodermal layer.

All these peripheral bundles are capped externally by the sub-epidermal patches of fibres. The larger bundles are also capped internally by other patches of fibres, thus forming simple I-girders. The remaining vascular bundles, scattered in the central part of the culm are of the first order. Each bundle is surrounded by a sclerenchymatous sheath, more developed towards the xylem side. The outer region of the ground tissue is chlorenchymatous. The chlorenchyma tissue radiates around the small bundles and on both sides of the larger bundles.

The remaining part of the ground tissue consists of thin-walled parenchyma cells with large air lacunae.

Tannin cells are spread among the ground parenchyma cells, and less frequently in the phloem and xylem parenchyma.

3. Leaf.

a) Lower Epidermis in Surface View.

The lower epidermis is formed of parallel bands. The differentiation of these bands is due to the arrangement of stomata in rows confined to regions above the assimilatory tissues. Otherwise, the

epidermis is formed of a uniform layer of thin-walled rectangular finely pitted cells. The subsidiary cells of the stomata are narrower in size than the guard cells.

b) Upper Epidermis in Surface View.

The structure of the upper epidermis is similar to that of the lower one, except that the stomata are absent.

c) Transverse Section. (Fig. 12).

In detailed structure, the leaf of *C. Schimperianus* does not differ much from that of *C. rotundus* leaf except for the upper epidermis which is similar in size to those of the lower epidermis.

The characteristic pyramidal crystals which have been observed in *C. rotundus* could be also seen.

D. CYPERUS ALOPECUROIDES, ROTTB.

I.—Morphological Description.

C. alopecuroides is a tall robust perennial sedge common on canal banks, on shores of lakes and as a weed in the rice fields. It is cultivated for mat making and for filling rush-bottomed chairs.

II. — ANATOMY

1. Root.

In transverse section, the piliferous layer is followed by the cortex which is differentiated into 3 zones. The outermost zone is narrow and is formed of 4 to 5 layers of suberised thick-walled cells. The middle zone is aërenchymatous and is formed of alternating radial rows of round cells and tangentially elongated cells. These tangentially elongated cells have been also observed in *C. Schimperianus* and *C. rotundus*. The inner zone which includes the endodermis is composed of 4 to 5 layers of roughly rectangular thick-walled cells with rounded corners and intercellular spaces. The endodermis is formed of larger cells with the 4 walls thickened and lignified, and is lined internally by a thin-walled pericycle.

The xylem arches are few in number with few and wide meta-xylem vessels. The pith is thick-walled and lignified. Tannin cells occur here and there outside the pith.

2. Culm.

a) Epidermis in Surface View. (Fig. 13).

The epidermis of the culm is homologous with the other studied *Cyperus* species in being formed of narrow bands of rectangular cells with slightly rippled and pitted walls alternating with broader bands formed of larger cells.

Stomata of the grass type, arranged in, 1 or 2 rows are found among the broad bands. The subsidiary cells are usually narrower than the guard cells, similar to those of *Cyperus Schimperianus*.

b) Transverse Section (Middle region) (Fig. 14).

On the whole, the anatomical features of the culm in transverse section do not vary much from those of *Cyperus rotundus*, specially in the arrangement of the vascular bundles and the presence of the sub-epidermal fibrous patches. Only little differences could be traced. The peripheral vascular bundles in *C. alopecuroides* are better developed than those of *C. rotundus* and have thick-walled bundle-sheaths. The central region of the ground tissue in *C. alopecuroides* is aërenchymatous with wider air lacunae than in *C. rotundus*. These minor differences may be ascribed to the larger size of the culm of

3. Leaf.

a) Lower Epidermis in Surface View.

The epidermis is again formed of parallel bands of cells: broad bands with polygonal or rounded cells, elongated on the sides, and narrow bands with narrow and more elongated cells. Rippling is also more pronounced in the broad bands.

Stomata of the grass type are included in the middle regions of the broad bands in two to four rows.

b) Upper Epidermis in Surface View :

The upper epidermis does not differ much in structure from the lower epidermis. The main difference lies in the absence of stomata. It was also noted that the broad bands are made up of uniform cells.

c) Transverse Section (Fig. 15).

The leaf is also V-shaped in transverse section but it appears much thicker compared with that of *Cyperus Papyrus*. On the whole, the structure of the leaf is more or less the same as that of *C. Papyrus*. The epidermis is also formed of rectangular cells subtended by patches of fibres, but the cells at the junction of the two arms do not differ in form from the neighbouring epidermal cells.

Again, in the mesophyll, three types of cells can be differentiated : (1) chlorophyll-containing cells around the small peripheral vascular bundles of the third order and below the larger bundles of the first and second orders. (2) parallel bands of ordinary parenchyma cells generally below the bundles of the first and second orders.(3) stellate parenchyma cells with wide intercellular spaces. The parallel bands of parenchyma cells take the form of columns connecting the vascular bundles with the upper and lower patches of fibres, and form together simple I-girders.

ANATOMICAL DIFFERENTIATION

The anatomical differentiation was based on the study of the plant material, modern and ancient, in the different organs of the plant such as roots, culms and leaves.

A. The Epidermis :

The epidermis in the *Cyperus* species studied was found to be striated into bands between the veins and these enclose the stomata and bands over the vein. This is quite common in most groups of plants to which the tomb plants belong such as halfa grasses, reeds, rushes etc. but the epidermal layer was found to exhibit special characters in these different groups. Thus, the halfa grasses and reeds possess sinous or rippled epidermal walls (Greiss, 1955), in addition to the presence of suberised and silica cells intercalated between the epidermal cells. The rushes and palms possess stomata with bean-shaped guard cells. The sedges, on the other hand, possess almost rippled wals and gramineous stomata. The epidermal strips of the 4 *Cyperus* species studied were compared. In *Cyperus Papyrus* the alternating bands are relatively narrow and the stomata are arranged in single rows while in the order three *C.* species, the stomata are found mostly in two tows. Moreover, in *C. rotundus*, the subsidiary cells are short and broadened laterally to give in most cases a wing-like appearance. But in the other two species i.e. *C. Schimperianus* and *C. alopecuroides*, the subsidiary cells are narrow and elongated.

Trials were also made to differentiate between the different parts of the plant through the examination of the epidermal strips as follows :

Cyperus Papyrus : No sharp character could be found to differentiate between the epidermal layer of the middle part of the culm and the other organs as the linear green foliaceous bracteole and umbel ray. In these cases, the epidermis is formed of parallel bands of 2 types of cells : bands enclosing the stomata formed of thick-walled cells alternating with bands of thin-walled cells.

Close to rhizome, the epidermis of the culm is not differentiated into bands. In the lower region of the culm, the bands are differentiated but stomata are lacking. In the upper region of the culm, the epidermal cells are all relatively thickened and still arranged in parallel bands but stomata are present. In the uppermost part of the culm, the epidermis is differentiated into bands of homogeneously arranged and less thickened cells. The bands are, however, distinguished by the presence of stomata in one and their absence in the other.

"Aiguillons" are found in the epidermis of the umbel rays and their subtending bracts. Again no stomata can be traced in the lower regions of the culms and upper surfaces of bracts.

Cyperus rotundus : The parallel bands are still common in both the culm and the leaf epidermis specially the lower one where stomata are present. But the bands are well differentiated in the culm owing to variation in size of cells and thickness of the cell walls. On the lower leaf surface, striation of the epidermis is actually due to the stomata being confined to regions above the assimilatory tissues, and the alternating bands can hardly be distinguished by cell structure. It was also noticed that in the leaf the bands devoid of stomata are much narrower than those of the culm, when compared with the

stomata including bands. Also the latter bands are formed of more elongated and thinner-walled cells in the leaf than in the culm.

Moreover, stomata which are frequent in the lower epidermis of the leaf, even more than in the culm, are actually absent in the upper epidermis. Hence, parallel alternating bands can hardly be differentiated.

Cyperus Schimperianus : The culm epidermis is similar to the leaf epidermis in being formed of parallel alternating bands. The stomata are relat:vely more frequent in the lower epidermis of the leaf than in the culm epidermis. Stomata are absent from the upper leaf epidermis. Further detailed difference between culm and leaf in *C. Schimperinus* are the same as those mentioned above conare the same as those mentioned above concerning *C. rotundus*.

Cyperus alopecuroides : The culm and leaf epidermal layers are both well differentiated into broad bands of wide rectangular cells enclosing the stomata and narrow bands of narrow more elongated cells, devoid of stomata. But the lower leaf epidermis is formed of alternating broader and narrower bands than those of the culm. Also, the stomata are much more frequent on the lower leaf surface than in the culm. The upper epidermis of the leaf is formed of parallel bands which are not well differentiated as in the lower epidermis. Moreover, stomata are absent.

B. Transverse Sections.

The transverse sections of the different organs belonging to the 4 plants under investigation were also compared. To facilitate the comparison between these organs, they were classified into :

1. Cylindrical organs of root structure.
2. Cylindrical organs of stem structure.
3. Bilateral organs.

1. Cylindrical Organs of Root Structure.

The aërenchymatous tissue was found common to the roots of *Cyperus* species examined. Such aërenchymatous tissues are also met with in halfa grasses, reeds, palms and rushes but the aërenchyma of the *Cyperus* species is quite peculiar in structure, specially in case of *Cyperus Papyrus*. Here the a:r spaces are much smaller and tangentially elongated compared with the other groups. They are bounded by armed parenchyma cells as in case of *C. Papyrus*. It was also noticed that in the 4 *Cyperus* species studied the inner region of the cortex abutting on the endodermis is formed of thick-walled cells. In the halfa grasses, palms, reeds and rushes, the inner region is thin-walled.

The roots of the 4 *Cyperus* spicies were studied. It was easy to note that the roots of *C. Schimperianus* and *C. rotundus* are much smaller in diameter than those of *C. Papyrus* and *C. alopecuroides*. This is normally accompanied by a wider cortex and a wider central cylinder in the latter species. However, the cortical aërenchyma of *C. Papyrus* is peculiar in structure as given above.

2. Cylindrical Organs of Stem Structure :

In the 4 *Cyperus* species, the culms were found to have more or less the same arrangement of tissues. Hypodermal patches of fibres occur in the 4 culms but they are best developed in the case of *C. alopecuroides*. Vascular bundles of typical grass type are scattered in the parenchymatous ground tissue. In addition to these bundles there are small poorly developed vascular bundles which may be formed only of phloem elements. Chlorophyll-containing cells radiate around the small peripheral bundles. It has been noticed, however, that *C. Papyrus* has peculiar aërenchymatous ground tissue in which the schizogenous air lacunae are surrounded by tri-armed cells. In *C. alopecuroides*, the air lacunae are smaller in size than those of *C. Papyrus* and are surrounded by rounded slightly angular cells. In *C. Schimperianus*, the air lacunae are quite wide as those of *C. Papyrus* but are surrounded by rounded cells.

In *C. rotundus*, the air lacunae are least developed and in size, they are more or less the same as the surrounding cells.

In case of *C. rotundus*, *C. Schimperianus*, and *C. alopecuroides*, only the culms can be considered in this connection, but in case of *C. Papyrus* the umbel-rays was also studied. This is very small in size compared with the culm. It is quite similar in the arrangement of the various tissues, but the aërenchyma in the umbel-ray is greatly reduced.

3. Bilateral Organs.

The bracts and empty basal sheaths of *Cyperus Papyrus* together with the foliage leaves of the three other *Cyperus* species namely *C. rotundus*, *C. alopecuroides* and *C. Schimperianus* were compared.

The *C. rotundus* leaf is peculiar in having an upper epidermis occupying in transverse section almost the third of the thickness of the leaf. The rest of the leaf is made up of the vascular bundles embedded in the chlorenchyma tissue.

The linear green foliaceous bracteoles of *C. Papyrus* is similar to the leaves of *C. rotundus* in internal structure but differs in the fact that the upper opidermis is of normal size throughout and there is an upper region of normal parenchyma cells situated between the upper epidermis and the chlorenchyma tissue.

In the basal sheaths of *C. Papyrus* and *C. Schimperianus* the upper epidermis is normal in size except over the midrib where the epidermal cells become more elongated perpendicularly to the leaf surface. They differ, however, in the fact that whereas the chlorophyll tissue is confined around the vascular bundles in *C. Papyrus*, in *C. Schimperianus* it extends over the vascular bundles in the form of a continuous layer. Moreover, the basal sheath of *C. Papyrus* possesses aërenchyma tissue made up of stellate parenchyma cells enclosing wide intercellular spaces.

The leaf of *C. alopecuroides* is characterised by having an upper epidermis of normal size throughout, more or less similar to the foliaceous bracteoles of *C. Papyrus* but it differs, however, in the fact that the vascular bundles are spaced apart by patches of aërenchyma tissue formed of stellate cells enclosing wide air spaces. The chlorenchyma tissue takes the form of a ring of cells radiating around the vascular bundles only.

ANATOMICAL IDENTIFICATIONS

Plant Materials from Various Sources.

(1) Agricultural Museum, Cairo, Egypt.

A rich collection of ancient plant materials is housed in the Agricultural Museum, Cairo. These materials belong to various groups of plants but the following objects are those which were found to be made either partly or wholy of *Cyperus* plants :

1. A thick rope from the First Dynasty (about 3100 B.C.) made of twisted culms of *Cyperus Papyrus*.

2. A large sieve from the Roman Period brought from Tebtinis, Fayoum, of 45 cms in diameter made partly of split and twisted culms of *Cyperus Schimperianus*, split midrib of *Phœnix dactylifera* and leaves of *Saccharum biflorum*. No. 167.

3. A holder (of unknown date), made of the split culms of *Cyperus Papyrus* and the culms of *Desmostachya bipinnata*. (No. 58).

(2) From the Egyptian Museum, Stockholm, Sweden.

Samples of different materials were brought from the Egyptian Section, Stokholm.

The following are those which were identified to be composed of *Cyperus* plants.

1. A rope (about 5 cms. long) from the Third Dynasty, brought from the Step-pyramid of Saqqara, made of a split culm of *Cyperus Papyrus*. (No. E. L029).

2. A lid of a basket made of split culms of *Cyperus Papyrus* and leaflets of *Phoenix dactylifera*. (No. E. 1007).

3. A part of a rope brought from Luxor, Egypt, by Gayer Anderson, made of the split culm of *Cyperus Papyrus*. (No. E. 1181).

(3) From Helwan Excavation.

The site of this excavation lies on one of the Nile terraces in Helwan district. The excavation work started in 1942. The tombs excavated belong, according to Prof. Z. Saad, to the First Dynasty. The ancient materials are kept in the Museum of Helwan Excavation

Objects that were examined and in which Cyperus plants were found to be used either partly or wholly are as follows :

1. A basket coffin with a cover enclosing the mummy of a child, made of 3 different plants : culms of *Cyperus Papyrus*, leaves of *Desmostachya bipinnata* and stem splits of *Ceruana pratensis*, (Tomb No. 54/H7).

2. A basket coffin of a child, made of culms of *Cyperus Papyrus*, (Tomb No. 54/H6).

3. Part of a rope made of twisted split culms of *Cyperus Papyrus* (Tomb No. 72/H4).

(4) From El Omari Excavation.

El-Omari Excavation lies at the edge of Helwan plateau near the mouth of Wadi Hof. El-Omari site according to Debono (1948) is a predynastic settlement.

The following objects which are made up of Cyperus plants are among the plants materials identified in Debono's collection of El-Omari :

1. Fibrous material of culms of *Cyperus sp.* (Ref. in Debono's collection : A 34 (IV).

2. A piece of a mat used as coffin made of desintegrated culms of *Cyperus species* and *Phragmites communis* (No. A 136).

3. A part of a mat made of culms of *Cyperus species* (No. A 163,a).

Occurrence and Uses

The most commonly known sedges to the Ancient Egyptians are two species of Cyperus, namely *Cyperus Papyrus* (generally known as Papyrus), and *C. alopecuroides* (the mat-sedge). The two other species mentioned in the present study are much less common.

Cyperus Papyrus.

This is one of the most famous plants in Ancient Egypt. It gained its fame from its use in paper making; the findings of papyrus rolls were one of the main clues to ancient Egyptian civilization. These rolls are now universally exhibited in the Egyptian sections of almost all museums of the world.

Though all the species of sedges recorded in the present text are still represented in the recent flora, *Cyperus Papyrus* is well known to have disappared as a wild plant growing in Egypt. This may be attributed to the fact that papyrus was cultivated in the remote times but that people later on ceased to cultivate it. It may be also be due to the gradual development of the Nile Delta and to the projects carried out by the system of improved drainage and which included the drying out of marshes.

Papyrus was used not only, in making paper rolls, but was applied also for many other purposes. The rhizomes were used as food, the inner part of the culm for medicinal purposes, the whole plant for making bouquets in funeral garlnads, the culms for making boats, sandals, mats, boxes, chairs, ropes, etc.

References on papyrus are so tremendous that they cannot be all included in the present paper. However, few examples can be mentioned. The most ancient substantial findings of papyrus date back to the predynastic period. The oldest papyrus paper known was found in the tomb of Hemaka and is about 5200 years old excavated by Emery and Saad (1938) and kept in the Egyptian Museum of Antiquiities at Cairo. Other old papyrus kept in the same Museum are from Abu Sir, 5th Dynasty and from Saqqara, 6th Dynasty.

Rhizomes of papyrus and the lowest part of the culms were used for food. This was mentioned by Theophrastus (Hort 1916) and Dioscorides in 78 A.D. (Gunther, 1934). One substantial find of papyrus rhizomes is known and discovered by Schweinfurth in Kom Aushim from the Roman period. They were kept in the Botanical Museum Berlin Dahlem which was destroyed during the last war. Papyrus umbels and culms were often used in the feasts and funeral rites.

Since predynastic times light rowing boats (rafts) were made out of papyrus culms strung togerher and narrowly tied at ends. A wonderful collection of all sorts of boat models made in different material and representing papyrus from various ages are kept in the Egyptian Museum of Antiquities, Cairo.

Papyrus culms have been used for rope making since very ancient times as reported by Theophrastus (Hort, 1916).

Petrie (1898) described a quantity of papyrus ropes found at Deshasha from 5th Dynasty.

From the New Empire, a thick rope is now kept in the Agricultural Museum, Cairo, (Ref. No. 1308) and was identified by the French Institute of Oriental Archeology.

In the present study, a thick rope from the 1st Dynasty found at Saqqara, a rope of split papyrus culms from the 3rd Dynasty, found in the step Pyramid at Saqqara were both identified.

Papyrus culms were also used in boxes and basket making (Petrie and Quibell, 1896; Petrie, 1898).

In the present paper 2 basket coffins enclosing the mummy of a child found in the Helwan excavation from the 1st Dynasty were examined. One was found made up of culms of *Cyperus Papyrus* together with *Desmostachya bipinnata* leaves and stem splits of *Ceruana pratensis*, while the other was made up solely of *Cyperus Papyrus* culms.

A tray with a holder (of unknown age) kept in the Agricultural Museum, Cairo, a part of a rope from Tura Cave, also of unknown age, and a rope kept in Stockholm Museum (Ref. No. 1181) were also identified to be made of *Cyperus Papyrus* culms.

A basket lid of papyrus culm and *Phoenix dactylifera* leaves kept in the Egyptian Museum of Stockholm was also determined.

Papyrus was also employed in making sandals. Many papyrus sandals were found in the tomb of Tut-Anhk-Amen from the 18th Dynasty. Quibel (1912) recorded the excavation of 6 pairs of sandals in the tomb of Yuya and Thuyu, from the 18th Dynasty. Sandals of papyrus and leather from the 19th Dynasty, were recorded by Petrie and Brunton (1924) at Sidmant el Gabal.

CYPERUS ALOPECUROIDES :

The use of *Cyperus alopecuroides* culms in mat manufacture was well known in Ancient Egypt since prehistoric times.

The oldest find is a mat of Badarian age (about 4500 B.C.) found at Mostagedda by Brunton (1937).

Schweinfurth (1896) indentified a mat of split stems found in a tomb from the 21st Dynasty at Deir El-Bahari. Another mat of entire culms was discovered in a tomb at Sheikh Abdel Qurna, Thebes dating back to 20th to 26th Dynasty. Many other finds of culms from Graeco-Roman period were also excavated from Rawara (Fayum) from 2nd to 3rd Century A.D.

Some parts of the culm dating as late as the Ist Century A.D. were used as strings to bind the garlands.

SUMMARY

This account is an anatomical study of a small group of sedges; 4 *Cyperus* species namely *C. Papyrus, C. rotundus, C. Schimperianus,* and *C. alopecuroides*. The work was carried out to provide a basis for identifying the 4 *Cyperus* species among the Ancient Egyptian materials. This was done by studying epidermal strips and transverse sections of the roots, culms and leaves. The detailed anatomical characters and the main differences are given in the text.

Plant materials brought from the Agricultural Museum, Cairo, The Egyptian Museum, Stockholm, Helwan Excavation, and El-Omari Excavation, were identified and are also mentioned in the text.

C. Papyrus was quite common to Ancient Egypt, and was boats, used in making paper rolls, bouquets for funeral garlands, sandals, mats, boxes, chairs, ropes etc.

C. alopecuroides was used in making mats.

C. rotundus was mentioned by many authors to have occured in Ancient Egypt but the present authors did not come across it during identification.

C. Schimperianus was found to be used in making large sieves during the Roman Period.

A short account of the occurrence and uses of the two most common *Cyperus* species i.e. *C. papyrus*, and *C. alopecuroides* in Ancient Egypt is given.

ACKNOWLEDGEMENT

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Fig. 1. — **Cyperus Papyrus** (L.) growing in a pool in the Zoological Gardens at Giza, about 1/50 natural size. Photo by Prof. T. M. Tadros.

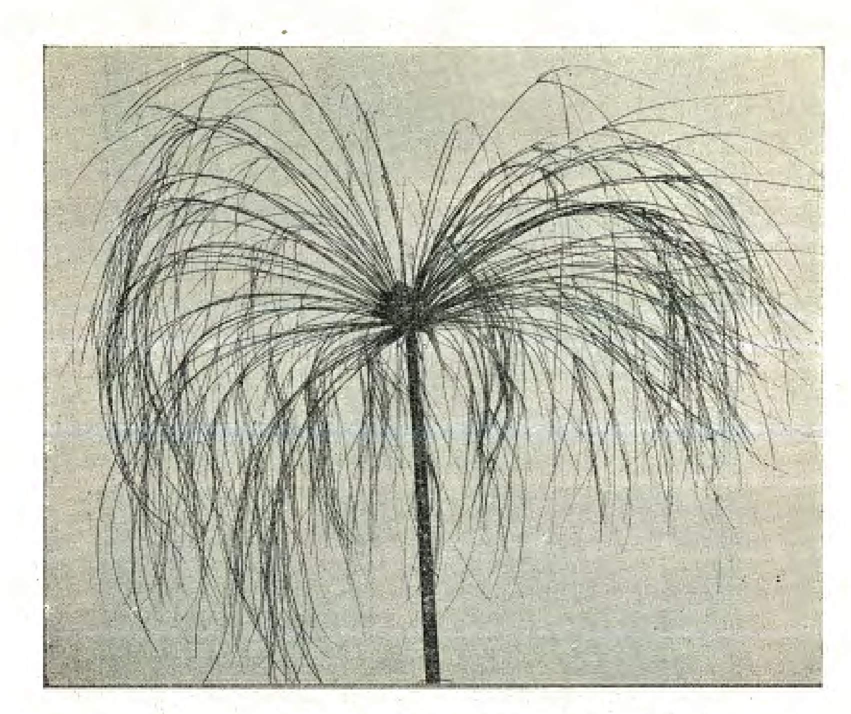


Fig. 2. — Top part of an adult Culm of **Cyperus Papyrus** showing the umbel rays and green foliaceous bracteoles forming an umbel About 1/6 natural size. Photo by Prof. T. M. Tadros.



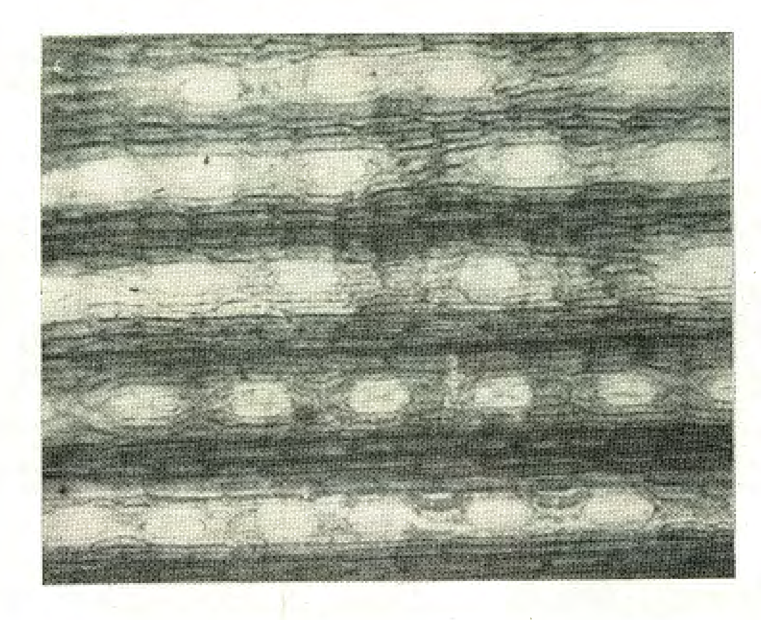


FIG. 3B. — Epidermis of the culm in surface view, x 250 (ancient).



FIG. 3 A. — Epidermis of the culm in surface view, x 250 (modern).



FIG. 4B. — Culm in transverse section (ancient), x 97.

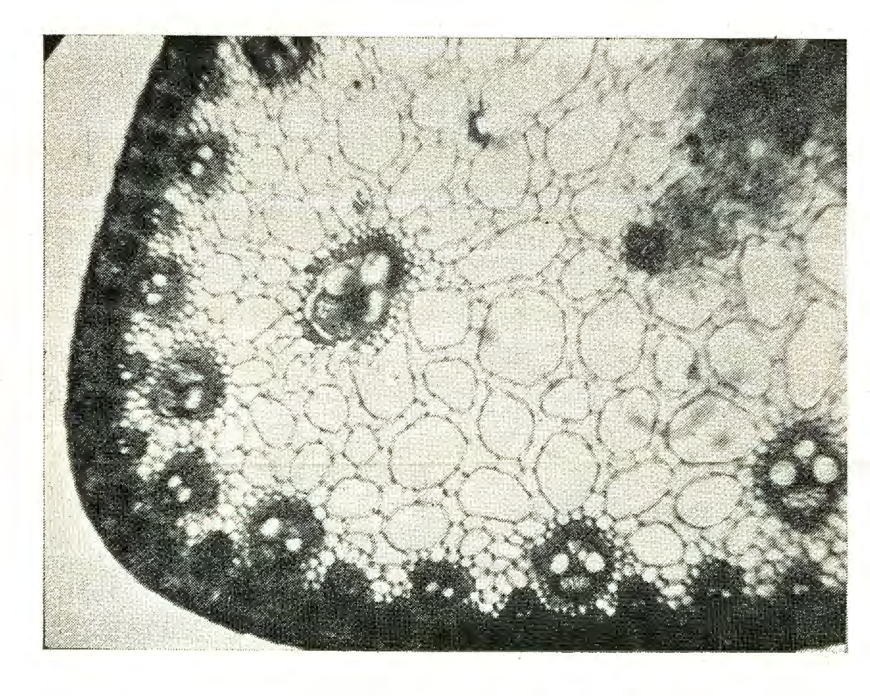


FIG. 4 A. — Middle region of the culm in transverse section, (modern), x 97.

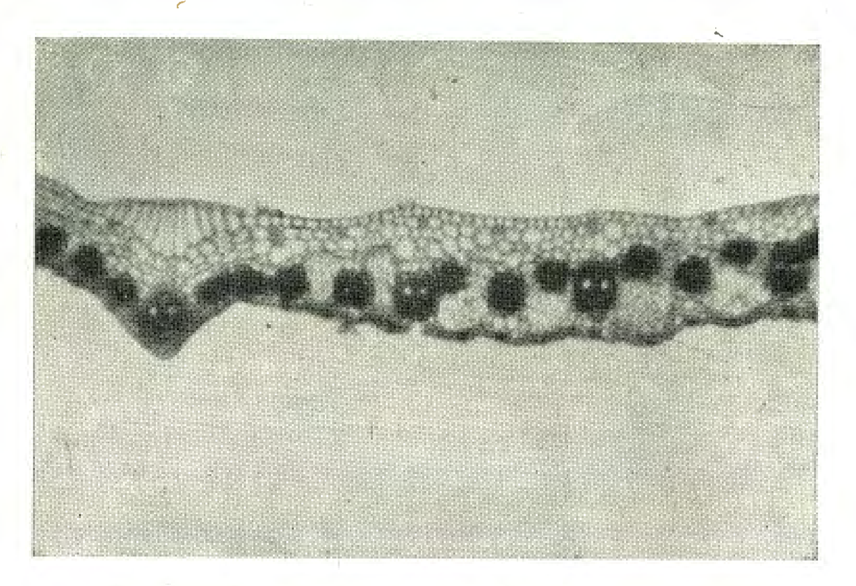


FIG. 5. — Middle region of a btact af a developing crown in transverse section, x 97

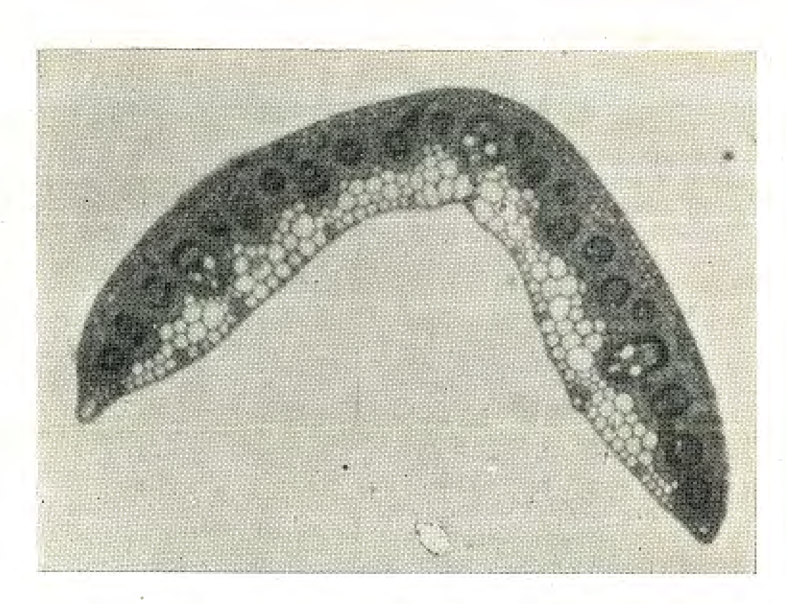


FIG. 6. — Lincar green foliaceous braclole in transverse section, x 97.

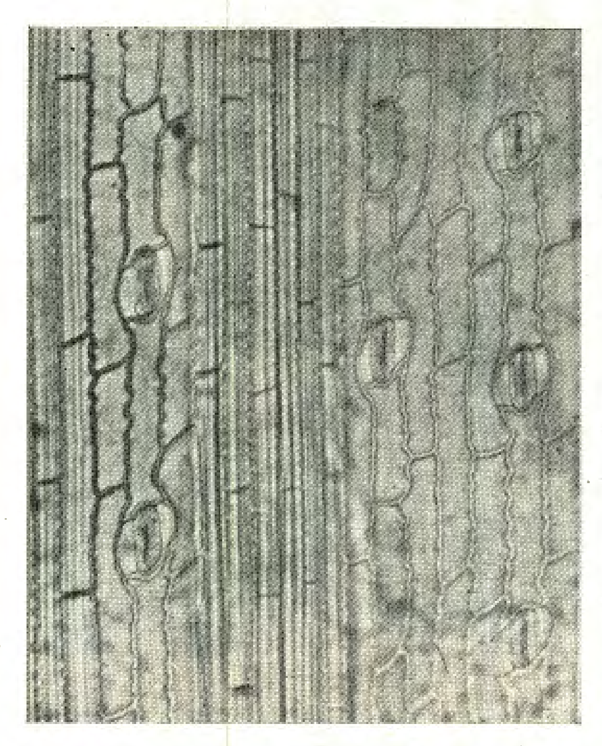


FIG. 7. — Epidermis of the culm in surface view, x 250.

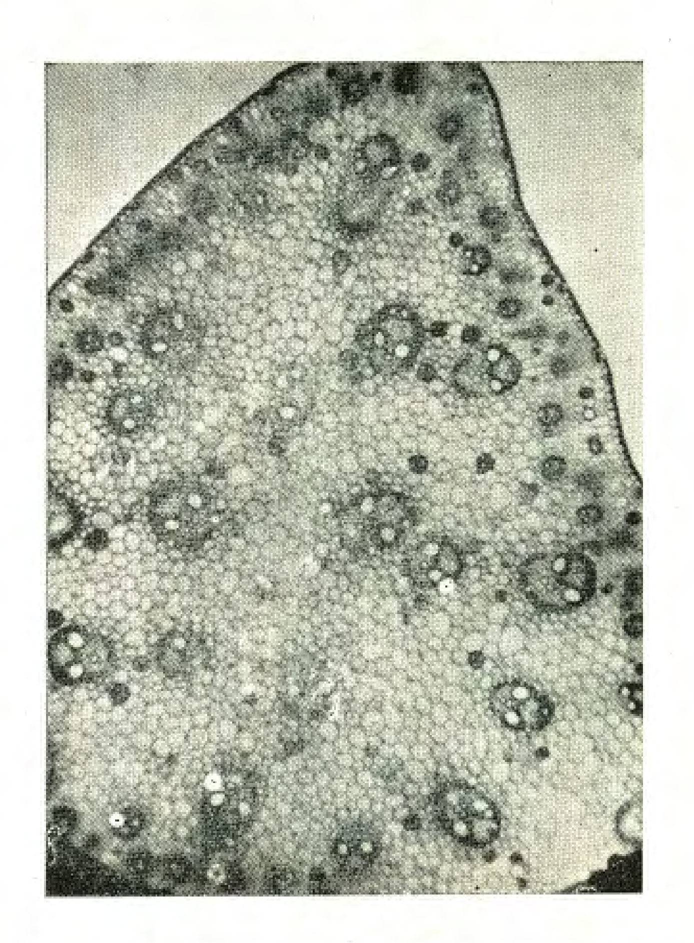


FIG. 8. — Middle region of the culm in transverse section, x 97.

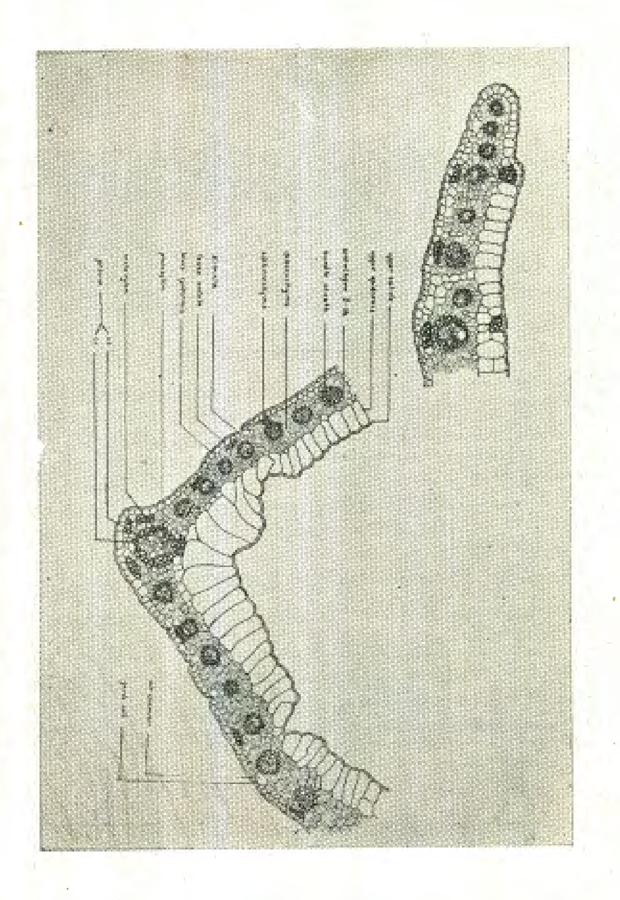


FIG. 9. — Middle region of the leaf in transverse section, x 57.

CYPERUS SCHIMPERIANUS.



FIG. 10. — Epidermis of the culm in surface view, x 250.

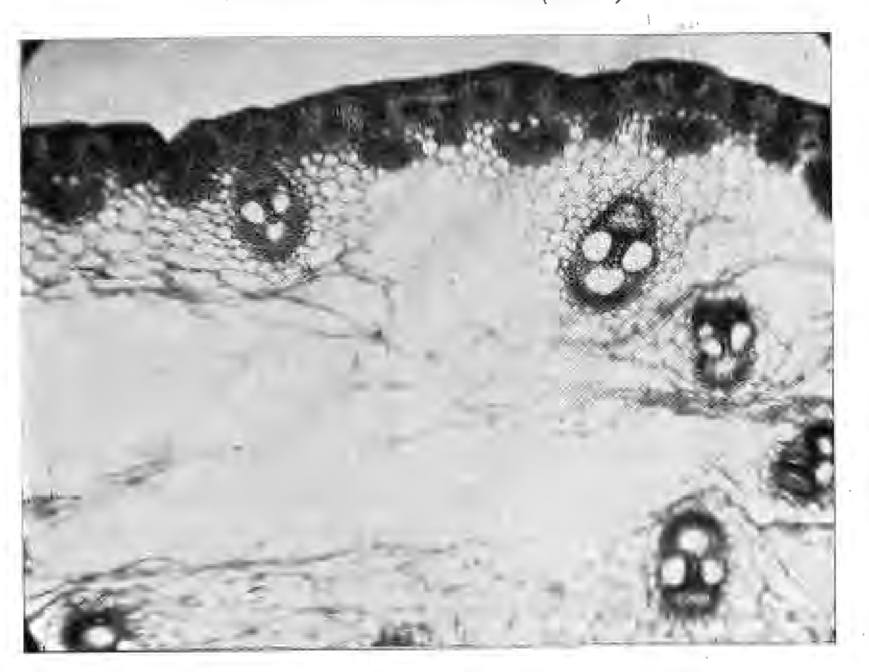


FIG. 11. — Culm in transverse section, x 97.

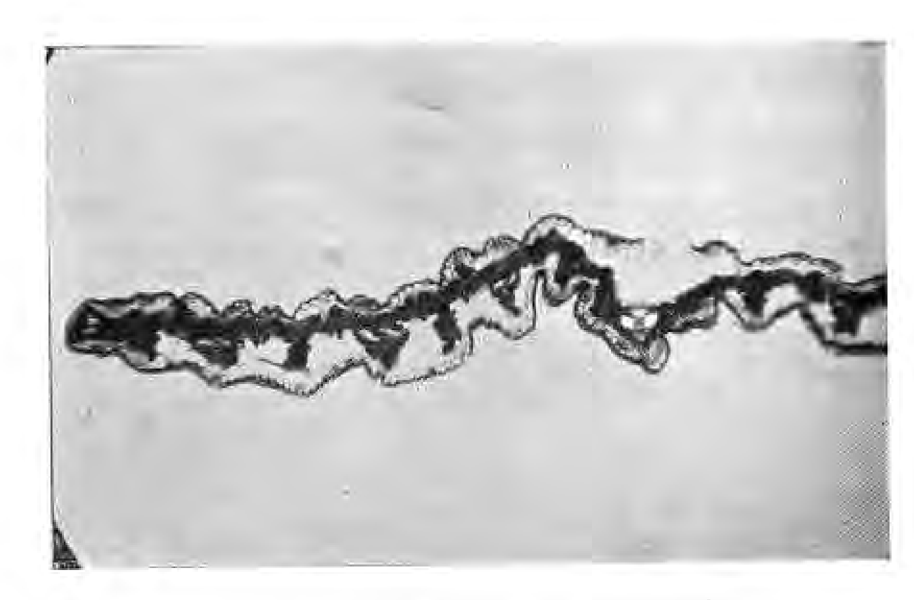
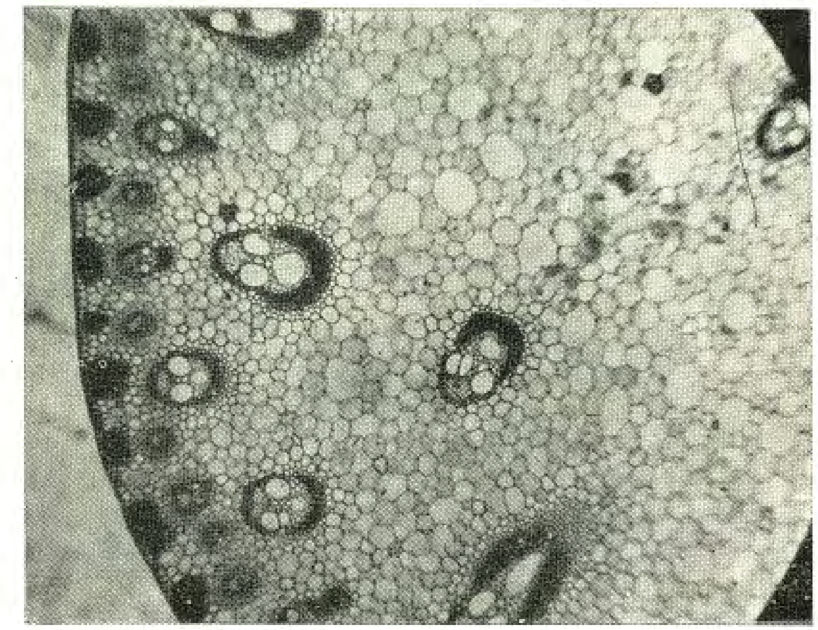


FIG. 12. — Leaf blade in transverse section, x 97.

Cyperus Alopecuroides.



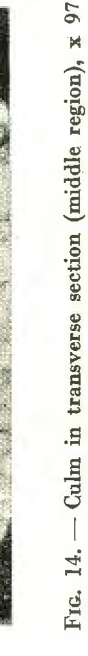


Fig. 14. — Culm in transverse section (middle region), x 97

Fig. 13. — Epidermis of the culm in surface view, x 250.



Cyperus Alopecuroides *(Cont.)*.

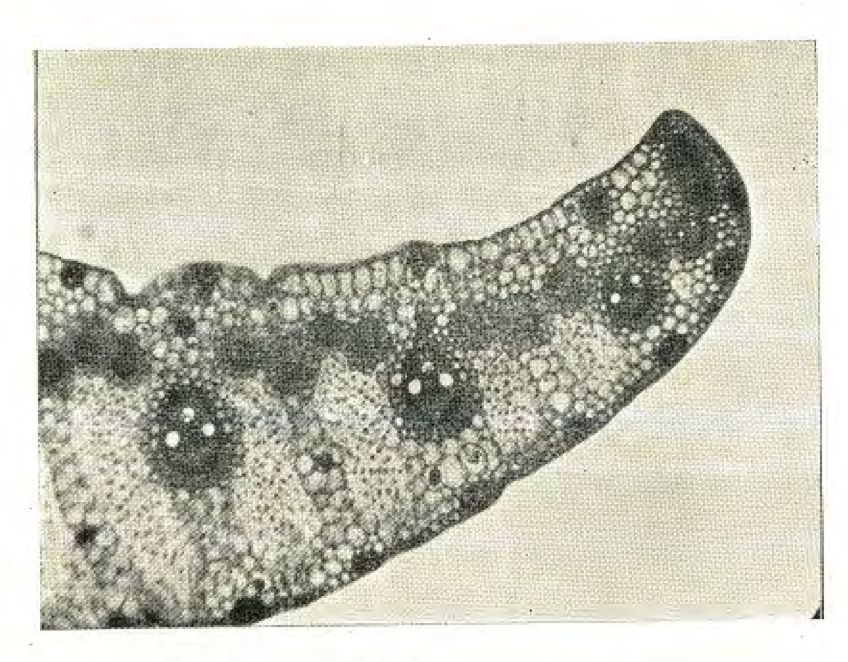


Fig. 15. — Leaf blade in transverse section, x 97.

The Origin and Early Development of Floriated Kufic [1]

by Prof. A. GROHMANN

Among the eight varieties of Kûfic
1. primitive or simple Kûfic (coufique primitif)
2. Kûfic with elaborate apices
3. foliated Kûfic
4. floriated Kûfic (coufique fleuri)
5. plaited or interlaced Kûfic (coufique à entrelacs)
6. bordered Kûfic [2]
7. architectural Kûfic (coufique architectural)
8. Kûfic rectangles (coufique carré)

the floriated Kûfic (no. 4) is the most attractive; it is the most decoratif variety of lapidary styles and marks a culminating point in the development of the Arabic script.

Inscriptions in floriated Kûfic are known to Western scholars since the first quarter of the XVIIIth century—two dated 348 and 392 A.H. respectively and found in Persia were reproduced by *Chardin* [3] — but they did not attract any special attention; only their difficult readability was repeatedly stressed. [4]. The origin of this script was in complete obscurity, and it was only at the beginning of the XXth century that theories about its origin were formed.

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(1) Communication présentée en séance du 25 avril 1955.

(2) According to the description of this variety, given by *S. Flury* in *Pope*, A survey of Persian Art II (1939), pp. 1743 f., 1745 (with fig. 602), that a purely *ornamental border* is added to the upper part of the band of writing, script and ornament thus forming two horizontal zones clearly separated from each other, it is actually no question of a new kind of *script*, but of a distinct accessive decoration of the *frame* only.

(3) Voyages en Perse III (Amsterdam 1711), Plate beside p. 118.

(4) E.g. by *J.J. Kehr*, Monarchiae Asiatico-Saracenicae Status (Leipzig 1724), paragraph 4. *Chr. Th. von Murr*, Inscriptio Arabica litteris cuficis auro textili picta in infima fimbria pallii imperialis Nürnberg 1790, p. 12; *J.J. Marcel*, Paléographie Arabe (Paris 1828), p. 10.



Fig. 1. Tombstone of Tashkend 230 A.H. (after *M. Hartmann*, OLZ IX, 1906, plate opposite col. 235).



Fig. 2. Tombstone of Qairawân 341 A.H. (after *Houdas-Basset*, Epigraphie Tunisienne, pl. III).

Before I go into details, it is necessary to make a clear differentiation between *a*) foliated Kûfic and *b*) floriated Kûfic, for both have been frequently confounded, even by experienced scholars.

Foliated Kûfic is characterized by the decoration of the *apices* of the letters, consisting of half-palmettes and two-or three-lobed leaves, the bifurcation of the endings of the letter Alif which might extend even to initial forms and the terminal letters (fig. 1,2).

Floriated Kûfic shows the same decoration, but in addition floral motifs, tendrils and scrolls growing from the terminations or even from the median forms of the letters (fig. 3,4). These tendrils are of course to be distinguished from those growing from the upper edge of the band of writing, or forming the floral background of the inscription (1). For the essential characteristic of coufique fleuri is that the tendrils and perfect arabesques form an organic unit with the letters from which they grow. (2) Since *J. G. Chr. Adler* (3) and *Marcel* (4) this floriated Kûfic is also known by the name Carmatian (Qarmatique, carmatique) which points to the Fâtimids Unfortunately no sharp distinction was made between foliated Kûfic and floriated Kûfic, the term coufique fleuri being employed for both styles of script. So e.g. the script of the inscription of the Gâmi' al-'Attârîn in Alexandria (5) is called coufique fleuri by *van Berchem*, although it is obviously *foliated* Kûfic. The script of the tombstone no. 4288 (dated 243 A.H., 857 A.D.) in the Museum of Islamic Art in Cairo (fig. 5), a rich foliated Kûfic, is even described by *Wiet* (6) as "coufique simple". So M. van *Berchem* has used the expression

(1) *S. Flury*, in *Pope*, A survey of Persian Art II, p. 1758, has included such inscriptions into foliated Kûfic, since the visual impression is the same.

(2) Cf. *E. Herzfeld*, OLZ xiv (1911), col. 432; S. Flury, Die Ornamente der Hakim- und Ashar Moschee (Heidelberg 1912), pp. 10 f., *W. and G. Marçais*, Les monuments Arabes de Tlemcen (Paris 1903), pp. 87, 88; *M. van Berchem*, Amida, p. 24.

(3) Museum Cuficum Borgianum Veletris (Rom 1782), pp. 11 f., 32 f., Arabes, elegantia scribendi supra modum forte studiosi, variis lineolis, ornamentisque illud augere inceperunt, e quibus denique alia scriptio orta est, quae primo obtutu a Cufica omnino aliena videtur, et re vera simplicitati, maiestatique Cuficae scripturae longe inferior est. A nostratibus Carmatica vulgo dicitur.

(4) *J.J. Marcel*, Paléographie Arabe, p. 10; *W. and G. Marçais*, op. cit., p. 88; *M. van Berchem*, Revue Africaine no. 257 (1905), p. 185; *N. de Khanikoff*, J A v série tom. xx (1862), pp. 129-130 ("coufique enchevêtré, improprement nommé karmatique")

(5) CIA 1/4, Egypte, p. 701 (MMAF xix, 1903). The same is the case with the inscription ibid. CIA I, no. 48 (p. 79), Pl. xviii no. 3, and no. 45 (p. 74), while the inscription of Badr al-Gamâlî of 480 A.H. (Bâb al-Futûh), showing a tendril with three-lobed leaf in Râ, is designated as "coufique fleuri à rinceaux" (CIA I, no. 36, Pl. xviii no. 2, p. 61).

(6) Stèles funéraires II (Cairo 1936), p. 28, Pl. IX.

"coufique fleuri à riches rinceaux" for genuine floriated Kûfic (1) e.g. in the inscription of the tympanums of the arches in the sanctuary of the Azhar Mosque, which *Flury* (2) called "a developed phase of Coufique fleuri". To this vagueness in terminology comes another inconvenience concerning method : in the investigations, hither-to made, extending to the decorated apices and the development of foliated Kûfic, the influence of the manuscript-style on the lapidary-script has been completely neglected, although *J. von Karabacek* (3) has pointed out this important phaenomenon as early as 1874.

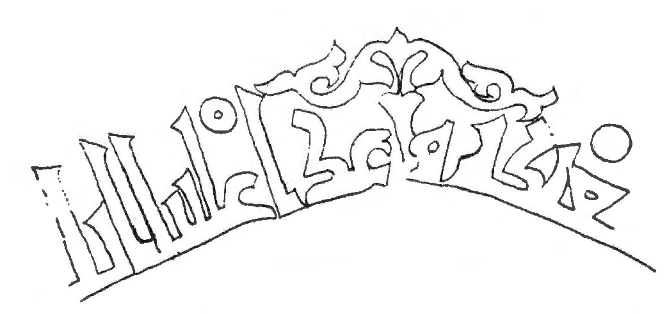


Fig. 3. Inscription in the transept of the mosque of al-Azhar, Cairo (after K.A.C. *Creswell*, The Muslim Architecture in Egypt, fig. 17, p. 54).

The problem of the origin of "Coufique fleuri" was first discussed by *W. and G. Marçais* (4) in 1903; he said that this angular floriated character, known as Carmatian (quarmatique), appeared for the first time in Tunisia in 341 A.H. (5) and was then transferred to Egypt, perhaps by the Fâtimids. *M. van Berchem* (6) at first shared the same view in 1905, but, under the influence of the appearance of the famous stela of Tashkend, dated 230 A.H. (844 A.D.) (7), he changed his opinion (8) and considered this epigraphical document as the oldest

(1) CIA I, no. 31, p. 53, Pl. XVI no. 2.
(2) Syria XVII (1936), p. 368.
(3) Beiträge zur Geschichte der Mazjaditen (Leipzig 1874), pp. 16, 51-53, 56, 64-65.
(4) Les Monuments Arabes de Tlemcen (Paris 1903), p. 88.
(5) The epitaph from the Qubba of Sidi Ribâh in Qairawân; *Houdas* and *R. Basset*, Epigraphie Tunisienne no. 16, Bulletin de Correspondence Africaine IV (Alger 1882), p. 126, Pl. III.
(6) Revue Africaine no. 257 (1905), p. 185.
(7) See below p. 5 and fig. 1.
(8) Amida, p. 24.

example known of this type of script, although he expressed serious doubts about the correctness of the date and said that the Tashkend stela undoubtedly was engraved later. *Martin Hartmann* (1) who had discovered this tombstone on the occasion of his journey to Turkestân in the Museum of Tashkend, declared this stela to be the preeminent example of the new style of writing, which manifests its existence so energetically in the Fâtimid inscriptions of 470 A.H. in Cairo, and arrived at the conclusion that this floriated Kûfic ("Blumensteil") has come *from the East* to Egypt (2). He was followed in this view by *J. Strzygowski* (3), who took the advancement of this ornamental script *from Central Asia to the West* as a proved fact, and even supposed that also the Kûfic palmette and the ornamentation of the Arabic tombstones in Cairo came from the East to Egypt and is related to the patterns of Persian textiles.

But both theories soon met with serious objections. First of all *J. von Karabacek* (4) proved with most serious arguments that the Tashkend-stela in question (A), published by *M. Hartmann*, is only a *copy* or *replica* of a stone originally dated 230 A.H., and is contemporaneous with a second tombstone (B) equally published by *Hartmann* (5) from the same Museum and dated 541 A.H. (1146 A.D.). *Karabacek's* view was fully approved by *Herzfeld.* (6) So the basic priliminary condition for an early appearance of Coufique fleuri in the East was eliminated. *Herzfeld* (7), in his famous review on *Strzygowski's* Amida, has further pointed out that the stela of Tashkend (fig. 1), used by *Strzygowski* as an argument for the spreading of coufique fleuri from Turkestân to the West, offers by no means this style of writing—no tendril, no flower. Indeed, a comparison of the two figures I and 2 with real floriated Kûfic (e.g. fig. 3,4) shows clearly that there is a frequent use of the lobed terminations of letters in *both* tombstones, but *nowhere* even a *disposition* to develop these terminations to a scroll, tendril or arabesque, growing out of the letters. So neither the stela of Tashkend (ca. 540 A.H.) nor that of

(1) OLZ IX (1906), col. 71-73.
(2) Ibid. col. 34.
(3) Amida p. 375; Ornamente altarabischer Grabsteine in Kairo, Islam II (1911), p. 334.
(4) Problem oder Phantom, Sb. Akad. Wien 178/5 (1906), p. 15.
(5) OLZ IX (1906), col. 235 and Plate opposite it.
(6) OLZ XIV (1911), col. 433. Islam V (1914), p. 363.
(7) OLZ XIV (1911), col. 432 f.

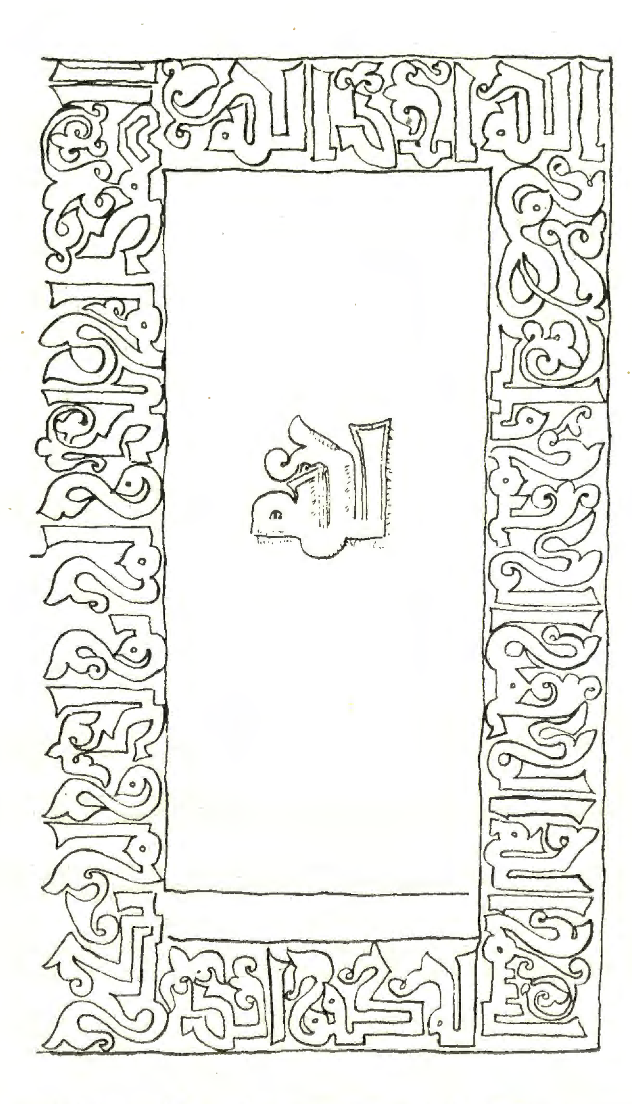


Fig. 4. Alabaster slab in the mausoleum of Shêkh Fathî, Mosul (after *Sarre-Herzfeld*, Archäologische Reise im Euphrat- und Tigris-Gebiet I, fig. 18, p. 28).



Fig. 5. Epitaph no. 4288 in the Museum of Islamic Art, Cairo. (After a photograph in the Museum of Islamic Art).

Qairawân (341 A.H.) can be considered as a priliminary step to the developed form of coufique fleuri, and the way from Tunisia to Egypt is out of the question.

But *Herzfelds* negative criticism of the theories of *Hartmann* and *Strzygowski* already contained *one* positive and important statement: i.e. the *decoration of the apices* by elegant palmettes, beginning on Egyptian tombstones since ca. 240 A.H., might be considered as a *preparation* for, or first step to, coufique fleuri. So the way was indicated on which further investigations had to start, especially, when new material, inscriptions as well as papyri, had come to light. In spite of the statement of *Flury* (1) that we obtain from Amida just as little information as from Cairo about the sudden appearance of the Kûfic decorative writing, it is in the first place *Egypt*, where the investigations concerning the *first steps* of the development of floriated Kûfic are vigorously demonstrated by papyri and epitaphs.

There is no doubt that the decoration of the letters begins with the most significant letter of the Arabic alphabet, the Alif. The top of the shaft is provided with a barb or hook, turned to the left or right. Both forms are connected with late Nabataean forms of the Alif in Sinaitic inscriptions—the former with Euting no. 657, the latter with Euting no. 329—and are to be found in papyri from Egypt and Palestine (Khirbet Mird) of the first to the third centuries A.H. The hook or barb then developes to a thorn or half arrow-head, a loop, a half-palmette and finally to a three-lobed leaf (437 A.H.) which had a decisive influence on the development of floriated Kûfic. The thorn apex and the three-lobed apex first occur on epitaphs in Egypt, dated 180 A.H. (2) and 192 A.H. (3) respectively and develop some years later to a three-lobed half-palmette (210 A.H.) (4) which is obviously connected with the same pattern occurring in the marginal decoration and as side-acroteria of the same tombstone. (5). This decoration is apparently taken over or imitated from Coptic tombstones, where it occurs already in the V/VIth century A.D. (6).

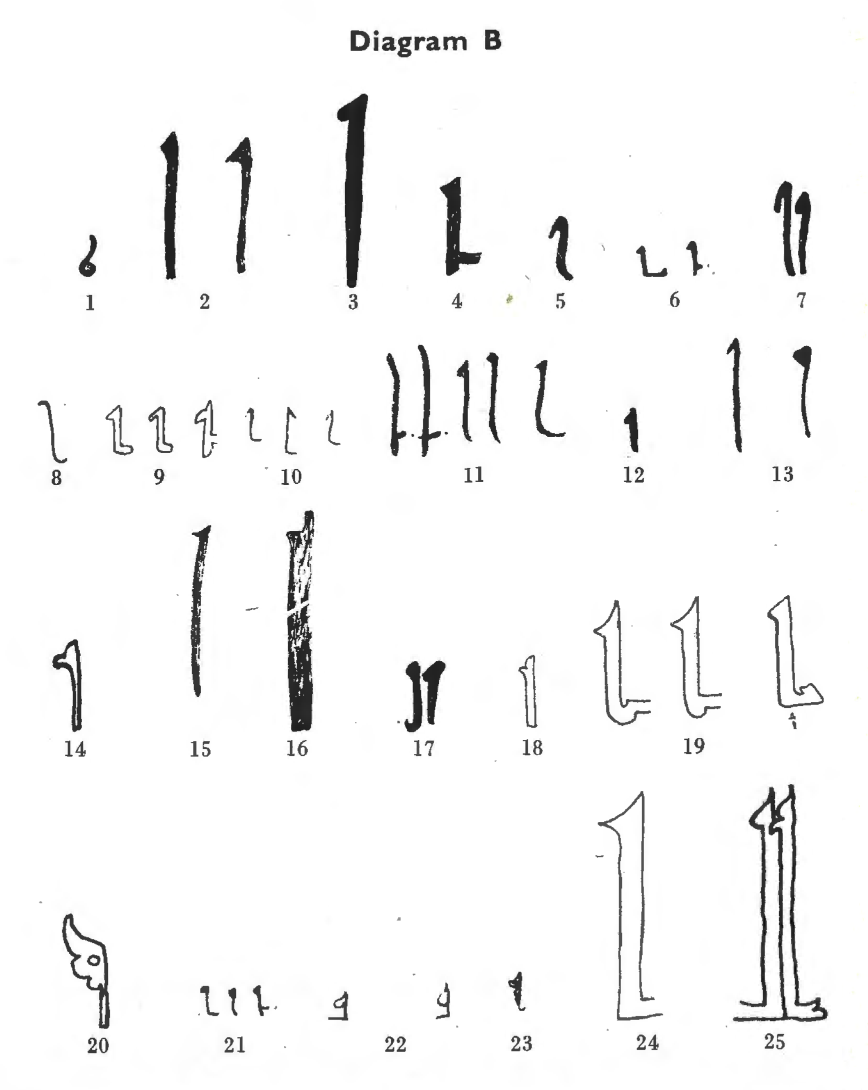
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(1) Islamische Schriftbänder Amida-Diarbekr (Basel 1920), p. 10.
(2) *Hawary-Rached*, Stèles funéraires, I, no. 1506/142, Pl. 1.
(3) Ibid. no. 1506/46 Pl. VII.
(4) Ibid. no. 4506/171, Pl. xxi, 210 A.H.
(5) Cf. Islam II (1911), fig. 5, p. 311. *Hawary-Rached*, op. cit. no. 1506/171 Pl. xxi, 1506/6 Pl. x, 3944/11 Pl. xi, ecc.
(6) Cf. Inv. no. 8609, 8585 in the Coptic Museum, Old - Cairo.

Diagram A

1. J. EUTING, Sinaitische Inschriften, no. 329. 2 HAWARY-RACHED, Stèles funéraires, no. 1193 (Pl. VI, 190 A.H.) 3. Ibid. 4. Ibid, no. 2711/138 (Pl. VIII, 196 A.H.). 5. Ibid no. 8360 (Pl. L, 232 A.H.). 6. Nilometer of al-Rôdha. 7. G. SALMON, Notes d'épigraphie Arabe (BIFAO II), no. 9 (263 A.H.). 8. E. HERZFELD, Arab Inschriften, fasc. III, p. 36. 9. Matin the Museum of Islamic Art, Cairo (Inv. no. 8244). 10. Tiraz, E. KUHNEL, Catalogue of dated Tiraz fabrics, Pl. XLIII, In. no. 73567. 11. Ibid, Pl. LI, XIth cent A.D. 12. Tirâz, Museum of Islamic Art, Cairo (Inv. no. 12224). 13. Tirâz C.J. LAMM, Dated or datable Tirâz in Sweden (Le Monde Oriental XXXII, 1938) no. 9 (334-358 A.H.). 14. S. FLURY, Islamische Schriftbânder Amida-Diarbekr, fig. 3 (476 A.H.). 15. G. WIET, Stèles funéraires, Pl. XVII (479 A.H.). 16. Ibid., Pl. XVIII (485 A.H.). 17. Ibid., Pl. XIX (511 A.H.). 18. S. FLURY, op. cit., fig. 6 19. M. LANCI, Trattato delle sepoltrali iscrizioni II (Eucca 1840), Pl. XX (517 A.H.). 20. Ibid., Pl. XXII (569 A.H.). 21. Ibid., Pl. XXX (650 A.H.).

Diagram B



1. J. EUTING, Sinaitische Inschriften, No. 657, Pl. XXXVIII. 2. Papyrus Khirbat Mird no. 4. (Ist cent. A.H.). 3. PER Inv. Ar. Pap. no. 1003 (Ist cent. A.H.). 4. Inv. no. 9291, Museum of Islamic Art, Cairo. (71 A.H.). 5. A.U. POPE, Assurvey of Persian Art, II, fig. 580 Makki script in Chester Beatty's manuscript of the Kitâb al-Fihrist. 6. Inscription of Ascalon (155 A.H. RAO I, Pl. XI). 7. PER Inv. Ar. Pap. no. 1920 (Second half of the IIIrd cent. A.H.). 8. ELITTMANN, Arabic Inscription, no. 136, p. 94. 9. HAWARY-RACHED Stèles funéraires I, Pl. 2 no. 1506/142 (180 A.H.). 10. Ibid., Pl. III. no 3360 (182 A.H.) 11. Gospel manuscript 279 A.H. (ZDMG XV, 1861, Pl. oppos. p. 384). 12. PER Inv. Ar. Pap. no. 2150 recto (IInd-IIIrd cent. A.H.). 13. PER Inv. Perg. Ar. no. 130 (IIIrd cent. A.H.). 14. PER Inv. Ar. Pap. 2149 (IInd-IIIrd cent. A.H.). 15 Tirâz Benaki Museum Athens no. 61 (286 A.H.). 16. Tirâz ibid. no. 144 (309 A.H.) 17. Arabic papyrus APEL III no. 8, Pl. III (309 A.H.). 18. Arabic Inscription CIA II, Pl. IV no. 18 (395 A.H.) 19. Plate, Museum of Islamic Art, Cairo (Ars Islamica III, fig. 4, oppos. p. 177, 386-411 A.H.). 20. M. LANCI, Seconda opera cufica III, Pl. XIX (437 A.H.). 21. Coran, 557 A.H. (Arabic Paleography, Pl. XLVII). 22. Epitaph (579 A.H.), J. KARABACEK. Beiträge zur Geschichte der Mazjaditen, p. 53. 23. Ibid., p. 53. 24. Inscription in the Mosque of al-Hasan, Cairo (750 A.H.) 25. Coran, 801, A.H. (Arabic Paleography, Pl. LXVIII).



Fig. 6. Decoration of a tombstone.
(After Der Islam II, p. 311, fig. 5).

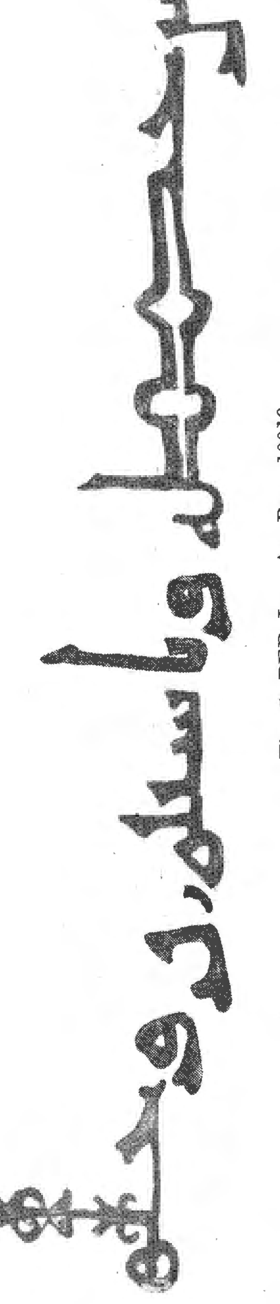


Fig. 7. PER Inv. Ar. Pap. 10019.

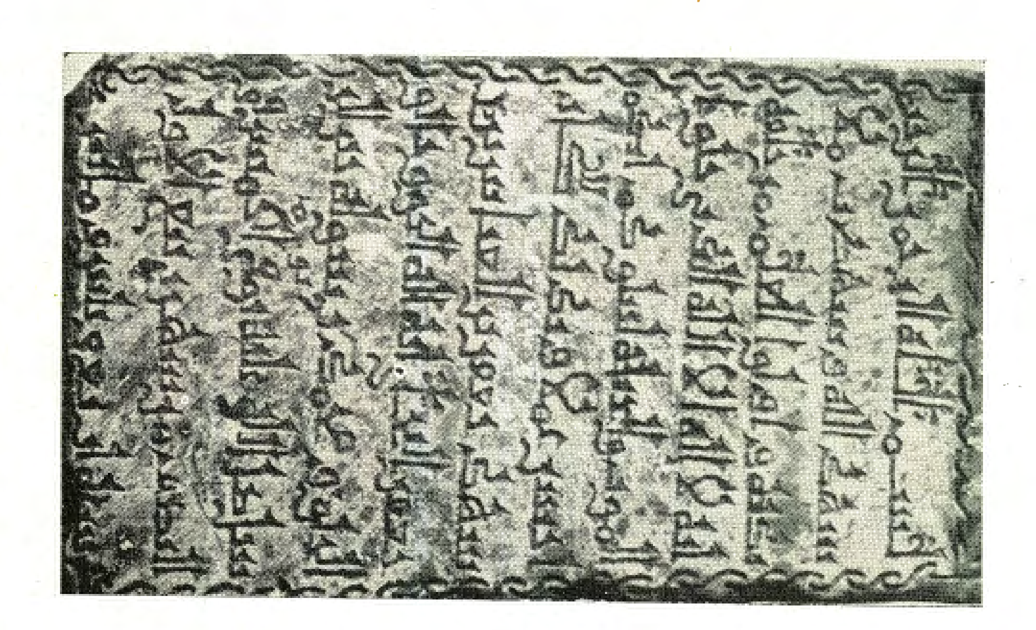
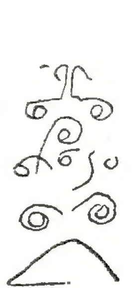


Fig. 8. Epitaph no. 1506/72 in the Museum of Islamic Art, Cairo.
(After a photograph in the Museum of Islamic Art).



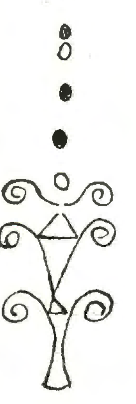


Fig. 9. Marginal decoration in a Greek manuscript (After *Stassoff*, L'ornement Slave et orientale, Pl. 120 no. 15).

Fig. 10. Decoration of a Coptic textile (After *M. Dimand*, Coptic tunics, fig. 19, p. 251).

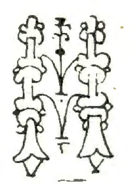


Fig. 11. Initial in a greek manuscript. (After *Bordier* Description des peintures et autres ornements contenues dans les manuscrits grecs de la Bibliothèque Nationale, fig. 38, p. 97).

E. Herzfeld (1) has noticed that with these palmette-like apices the preparation for coufique fleuri is effected. In 228 A.H. we see a further step in this evolution : the apex of the Alif is decorated in form of *a tree*, a decoration which occurs in terminal-Mîm already in an epitaph dated 217 A.H. (822 A.D.) (2) and has a parallel in the Lâm of a sketch on papyrus (PER Inv. Aṛ. Pap. 10019 fig. 7) dating from the first half of the third century A.H. and recurs in an epitaph (3) dated 234 A.H. (848 A.D. fig. 8). Also this floral decoration is borrowed from Coptic patterns of the V/VIth century A.D. (4) possibly connected with the marginal decoration of Greek manuscripts of the IV/V th century A.D. (fig. 9) (5) It represents the well known "tree of life" which not only recurs on Coptic epitaphs—e.g. no. 8585 in the Coptic Museum Old-Cairo—but also on Coptic textiles of the VI/VII th century A.D. (fig. 10) (6). The infiltration of such tree-patterns into a letter is not confined to Arabic writing; it is also significant for Greek initials, e.g. of the X th century A.D. in MS. Grec 438, dated 992 A.D. in the National Library in Paris (fig. 11) (7) and for the decoration of Hebrew manuscripts of the IX/Xth century A.D. (8) (fig. 12).

Already in 205 A.H. (820 A.D.) the decoration of the three-lobed palmette which was hitherto restricted to Alif and Lâm, is extended to other letters and increases more and more in the following years. Palmette-trees and palmettes are now used simultaneously as decorations of the letters—e.g. in the epitaph no. 1506/72, dated 234 A.H., 848 A.D.—and especially the three-lobed palmette prevails now more and more in Egypt, North-Africa (Qairawân 303, 306 A.H.), Persia, the Yemen and in Spain. Two highly developed forms may illustrate the almost unlimited possibilities of decoration : one is a stucco relief from Sâwa (Persia) found in the tomb of Tughril-

(1) Islam I (1910), p. 50.
(2) *Hawary-Rached*, op. cit. no. 1267 Pl. xxviii.
(3) *Hawary-Rached*, op. cit. no. 1506/72.
(4) *Dimand*, Coptic Tunics in the Metropolitan Museum of Art (New York 1930), p. 251, fig. 19. *A. F. Kendrick*, Catalogue of textiles from Burying grounds in Egypt II (London 1921), no. 354, 370 Pl. xix. (pp. 30, 34).
(5) Cf. *L. Stassoff*, L'ornement Slave et Oriental (Petersburg s.a.) Pl. 120 no. 15.
(6) Cf. Ars Islamica IV (1937), p. 382 fig. 28.
(7) *H. Bordier*, Description de peintures et autres ornements contenues dans les manuscrits Grecs de la Bibliothèque Nationale (Paris 1885), p. 97, fig. 38.
(8) *Günzberg-Stassoff*, Miniatures of Hebrew Bibles of the IXth and Xth centuries, Pl. VI.



Fig. 13. Stucco relief from Sâwa (after a photograph of Prof. K.A.C. Creswell)

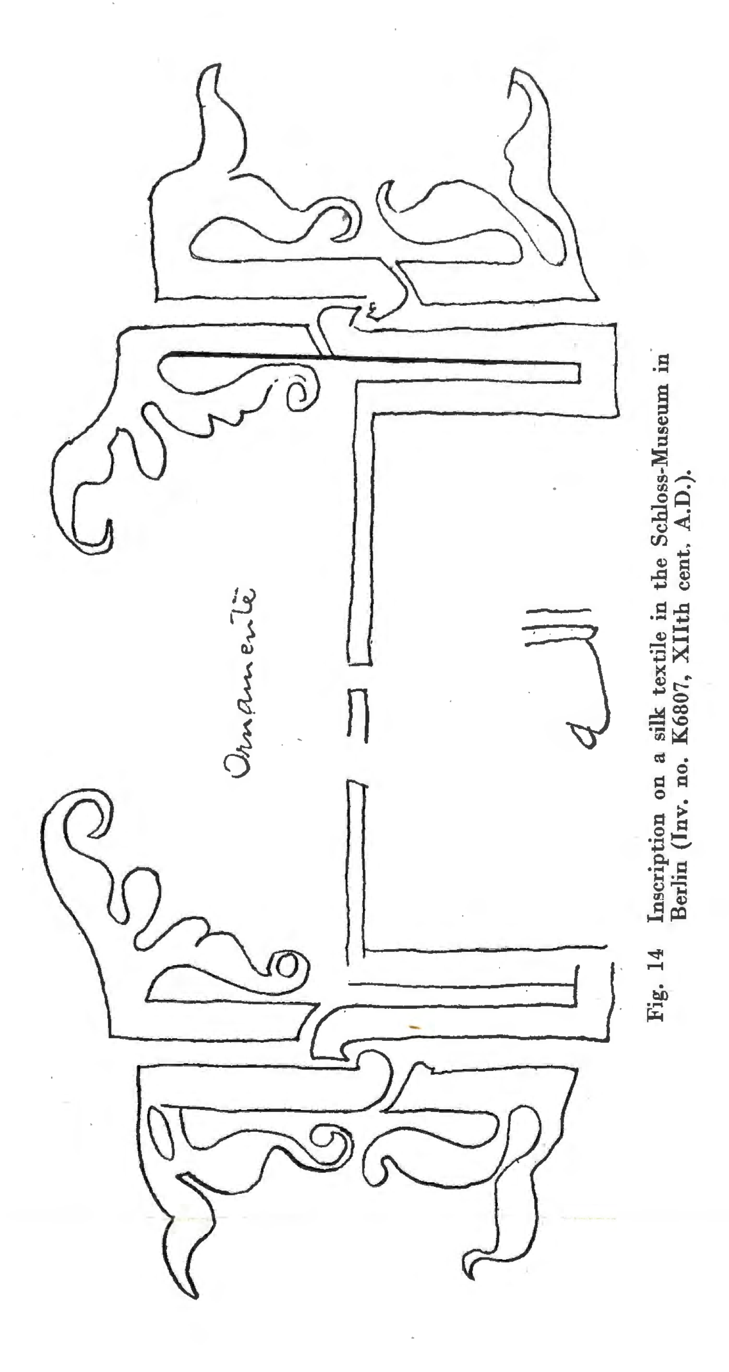


Fig. 14 Inscription on a silk textile in the Schloss-Museum in Berlin (Inv. no. K6807, XIIth cent. A.D.).

Bey II (died about 1202 A.D.) (fig. 13), (1) the second an inscription in the former Schloss-Museum in Berlin (fig. 14).

The highest and ripest degree of development is nevertheless reserved to the Fâtimid period, and the best examples are again shown by Egypt. And it is *here* that the evolution from *foliated* Kûfic to *floriated* Kûfic is accomplished. It has long been believed that the floriated Kûfic first appears in Amida (2) or had been brought to Egypt by the Fâtimids from North-Africa. We have already seen that the latter supposition is baseless. In return, an epitaph dated 243 A.H., (848 A.D.) in the Museum of Islamic Art in Cairo (Inv. no. 3904, fig.15) really shows full decoration of the apices with three-and four-lobed leaves and full-palmettes as well as tendrils growing up from the letters and filling in the blank spaces between the letters, motifs, which partly correspond to the palmettes of the marginal frame. Of two further inscriptions, which belong stilistically to the same period, one (Inv. no. 1241, fig.16) is preserved in the Museum of Islamic Art in Cairo, the other (3), dated 247 A.H. (861 A.D.), in the building of the Nilometer at ar-Rôdha. Three years later, 250 A.H. (864 A.D.) follows the remarkable tombstone from Higâz (fig. 17) : it not only shows genuine tendrils growing out of the terminations of the letters (Tâ, Mîm, Nûn, Kâf, Wâw), but also floral motifs, scattered in the spaces between the letters, motifs which also here correspond to the palmette-tendril in the marginal frame. The mutual relations are therefor absolutely obvious in both examples and give evidence for the origin and course of development which has already been exposed. So the middle of the third century of the Higra represents the evolution of foliated Kûfic to floriated Kûfic in *Egypt* as established and definitely existing. Further steps in this evolution certainly existed in the neighbouring countries, e.g. in Palestine, where an inscription of the time of al-Muqtadir billâh, dating between 300 A.H. (913 A.D.) and 317 A.H. (929 A.D.) in the enclosure wall of the Haram at Jerusalem (4) (fig. 18) shows an even more developed foliated Kûfic than the tombstone of 243 A.H. (fig. 15). This is all the more important since the inscription of the same Caliph in

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(1) *Pope*, A Survey of Persian Art, V (1938), Pl. 518.
(2) *S. Flury*, Islamische Schriftbänder Amida-Diarbekr, p. 11.
(3) See Kamel Osman Ghaleb Pasha, Le Mikyâs ou Nilomètre de l'île de Rodah, MIE LIV (1951), Pl. iv, no. 3.
(4) M. *van Berchem*, CIA II/i (MMIF xliv, 1925), no. 144, p. 7 ff. and fig. 2, p. 7.



Fig. 15. Epitaph no. 3904 in the Museum of Islamic Art, Cairo. (After a photograph in the Museum of Islamic Art).



Fig. 16. Inscription no. 1241 in the Museum of Islamic Art, Cairo. (After a photograph in the Museum of Islamic Art).

Fig. 17. Tombstone from the Higâz (dated 250 A.H.). After a photograph in the Museum of Islamic Art, Cairo



Fig. 18. Letters from the inscription of al-Muqtadir, Jerusalem.

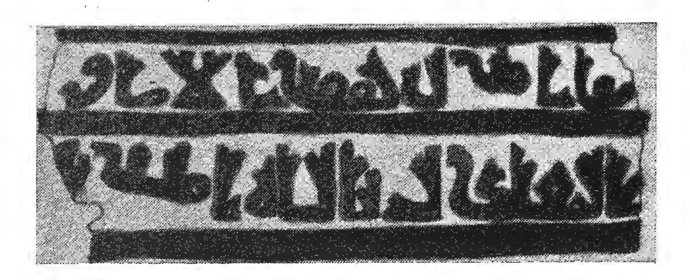


Fig. 19. Inscription of al-Muqtadir in Amida. (After *M. van Berchem*, Corpus inscriptionum Arabicarum II, fig. 2, p. 7).



Fig. 12. Decorated Hebrew letters.
(After *Günzber-Stassoff*, Minatures of Hebrew Bibles of the IXth and Xth centuries, Pl. VI).

Amida (fig. 19) represents a modest foliated Kûfî only. Anyhow, the high standard attained in Egypt is not yet traceable elsewhere. For the next period this initial phase of floriated Kûfic is not able to impose itself fully, even not in Egypt. This is proved by the terminations of Dâl, Râ, Nûn, Wâw and Yâ in a Tirâz (1) made in al-Fustât for the Caliph al-Mutî' lillâh (334-363 A.H., 945-974 A.D.) (cf. fig. 20) in large Kûfî with elegant arabesque endings in stems and tails characteristic of the early phase of "floral Kûfic", and by stone inscriptions in relief from the early Fâtimid period, e.g. Inv. no. 8832 in the Museum of Islamic Art in Cairo (fig. 21) and a marble-tablet in the Great Mosque in Esnâ (fig. 22), dated 474 A.H. (1081/82 A.D.), if compared with the fragments of an inscription containing the throne-verse (Sura II 256) from the North-East-wall of the Azhar-Mosque (2) (316 A.H., 972 A.D.) (fig. 23), where the half-palmettes in Alif, Tâ, Râ, Dhâd, Wâw already trend to the developed phase

(1) *E. Kühnel*, Archaeologica Orientalia in memoriam *E. Herzfeld* (New York 1952), p. 144 f., Pl. xxvi. A fragment of this tirâz is preserved under Inv. no. 12224 in the Museum of Islamic Art in Cairo. Fâ'iz was sâhib al-tirâz between 334 and 358 A.H. the fragment is therefore to be dated 344 A.H.

(2) Cf. *S.Flury*, Syria xvii (1936), p. 368 and fig. 2, p. 369, *K.A.C. Creswell*, Early Muslim Architecture, III, p. 57, 18, 19.

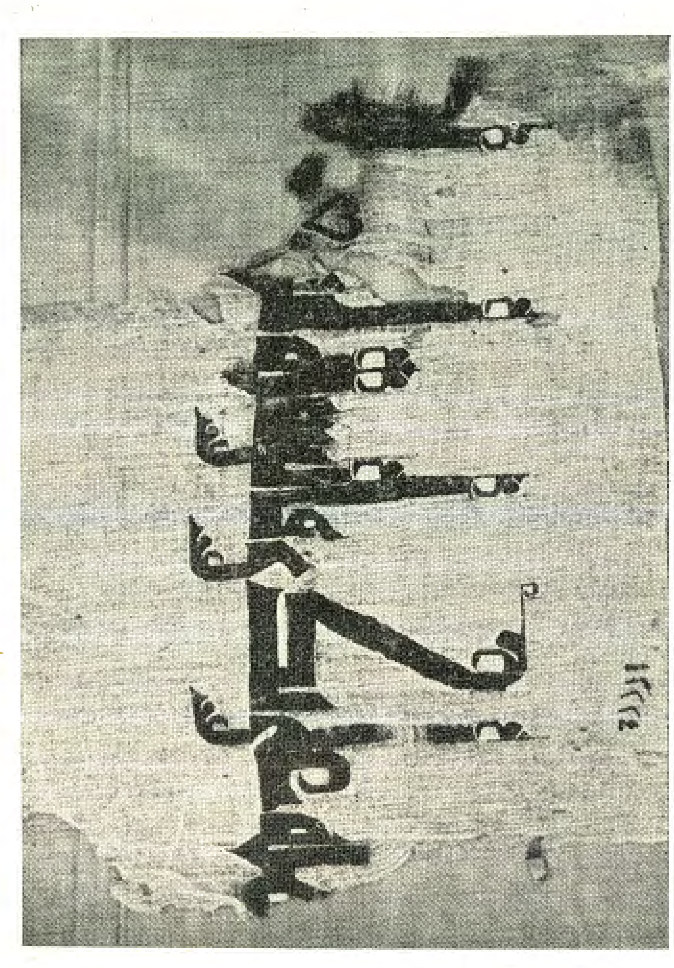


Fig. 20. Tirâz-inscription no. 12224 in the Museum of Islamic Art, Cairo. (After a photograph in the Museum of Islamic Art).

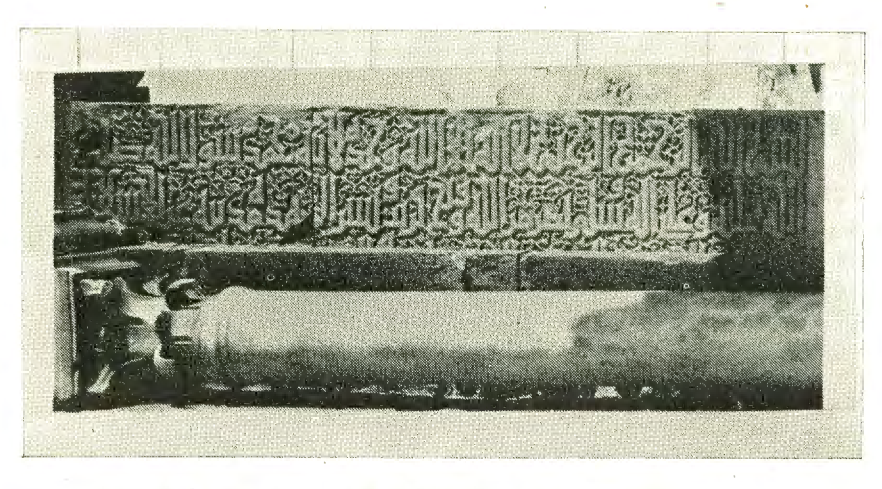


Fig. 25. Inscription of Bâb Tûnis (Qairawân, 437 A.H., 105 A.D.)
(After a photograph of Prof. K.A.C. Creswell).

of coufique fleuri. But even more apparently this is demonstrated by the bands of writing in the Hâkim-mosque (before 393 A.H., 1003 A.D.) (fig. 24) which show a quite particular connection of writing and floral tendrils growing out of the letters and forming with them an organic unit, serving at the same time as an ideal filling in of the space (Museum of Islamic Art, Cairo, Inv. no. 2639, 2640, and 6730)[1].

It is certainly from *here* that its development has advanced to Mesopotamia [2] on one side and to North-Africa on the other, where we find it, differing from that in Mesopotamia, in its most beautiful evolution in the inscription of the Bâb Tûnis in Qairawân (437 A.H., 1045 A.D.) [3] (fig. 25). Here as well as in the inscription of the sanctuary of the Mosque Sidi 'Oqba (406-453 A.H., 1015-1061A.D.) [4] the tendrils are apparently connected with the shafts and terminations of the letters, but so discretely that the impression of a floriated background is given.

(1) S. *Flury*, Die Ornamente der Hakim-und Ashar Moschee, p. 9.

(2) Cf. S. *Flury*, Islamische Schriftbänder Amida-Diarbekr, p. 10 f., fig. 1, Pl. II Amida no. 8, 426 A.H. 1034/35 A.D.; no. 9, 42. A.H., 1029-38 A.D., p.12 and Pl.III; Amida no. 10 Pl. iv 437 A.H., 1045/6 A.D., pp. 13-15; Amida no. 11 444 A.H., 1052/3 A.D. Pl. vi, p. 15).

(3) I owe the photograph to the courtesy of Prof. K. A. C. *Creswell*. The tendrils have been omitted in *Houdas-Basset*, Epigraphie Tunisienne, Pl. IX (cf. p. 191).

(4) Cf. *H. Saladin*, Les monuments historiques de la Tunisie II (Paris 1899), Pl. xxiii-xxv; *E. Herzfeld*, Islam xii (1922), p. 99.



Fig. 21. Stone inscription no. 8832 in the Museum of Islamic Art, Cairo.
(After a photograph in the Museum of Islamic Art).

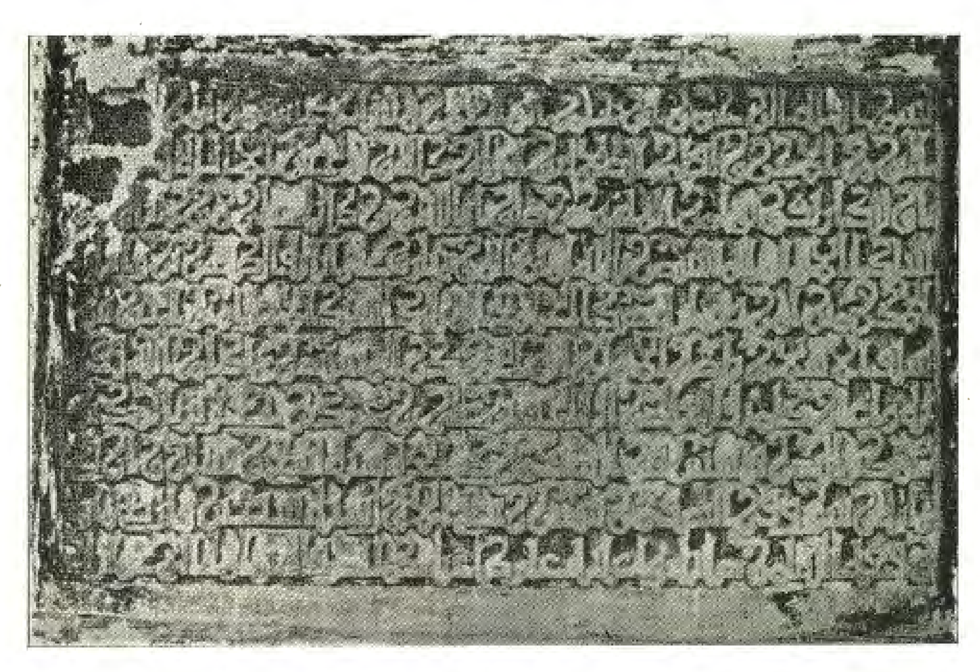


Fig. 22. Inscription in the great Mosque in Esnâ
(Inv. no. 4864, Museum of Islamic Art, Cairo, after a photograph in the Museum).

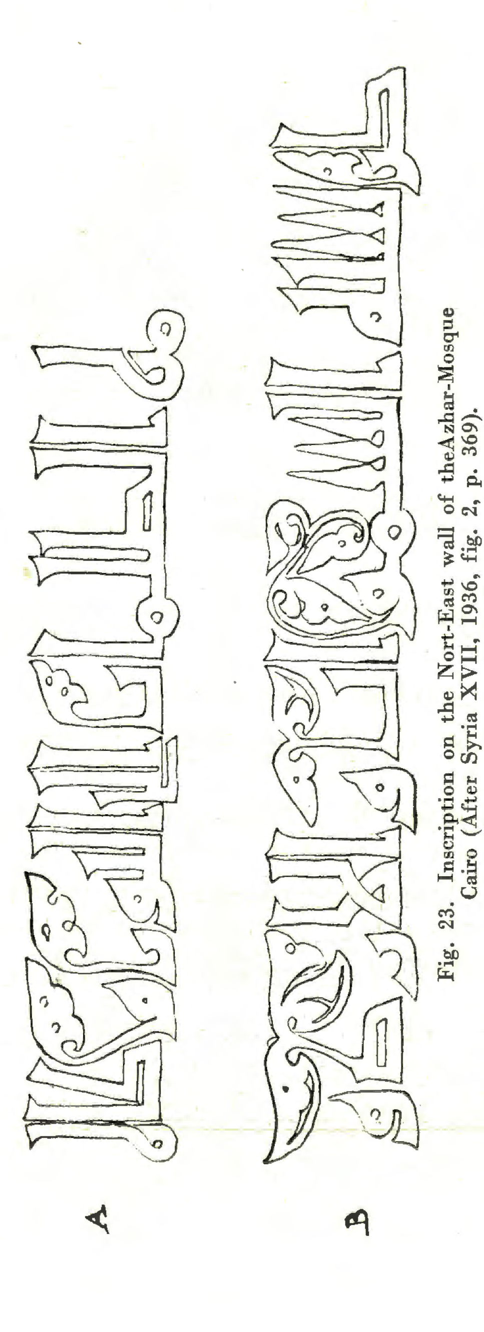


Fig. 23. Inscription on the Nort-East wall of theAzhar-Mosque Cairo (After Syria XVII, 1936, fig. 2, p. 369).



Fig. 24. Stone inscription from the Mosque of al-Hâkim in the Museum of Islamic Art, Cairo (After a photograph in the Museum).

But *where* has this peculiar decoration come into existence ? *S. Flury* (1) has, in connection with the discussion of the band of writing on the minarets of the Mosque of al-Hâkim, stated that the decoration of the North-Minaret shows motifs which are borrowed from *Coptic Art.* He further brought the tendril, growing out of Wâw (2) (fig. 26), into relation with the oldest Christian Art of Egypt referring to its prototyp on capitals, decorated with crosses, in the Arab Museum (3), and he supposed that the more developed "coufique fleuri" must have flourished already in the IVth (Xth) century, otherwise a band of this perfection would be unimaginable. (4)

It is astonishing that *Flury* did not risk the further step, so near at hand, to trace back the ornamentation of the Hâkim-Mosque to Coptic influence, as it would be expected according to the statement made above. He refers (5), concerning the letters, decorated with half-palmettes, to the textile of al-Hâkim in the South-Kensington Museum (Inv. no. 133-1896) and for the palmettes and small tendrils in the band of writing in the Azhar Mosque to Hebrew Manuscripts (6) containing letters with individual palmettes and small tendrils. Apparently the idea was present in his mind that these Hebrew manuscripts contained materials for a comparison which had not survived elsewhere. Certainly these manuscripts are of some importance, but they form—in the IXth and Xth centuries A.D.—at most intermediate links, for which older prototyps are to be supposed. If we, e.g. compare the Alif with the trefoil in the inscription on the North-Minaret of the mosque of al-Hâkim (7) (fig. 27) with the initial Ita in the Ms. Grec no. 423 in Laon (VIIth century A.D.) (8) (fig. 28) or with the initial T in

(1) Die Ornamente der Hakim-und Ashar-Moschee, p. 45. The western minaret shows initial 'Ain with palmette-shaped splitting of the initial stroke (Pl. xxix no. 3)—which recurs in the mosque Sidi Bû Medîne (xiith cent. A.D.) in *W. and G. Marçais*, Monuments Arabes de Tlemcen, p. 254, fig.55 — from the foot of Dâl grows a double-lined ondulating tendril (Pl. xxxiii no. i), while the upstroke of Dâl is three-lobed (Pl. xxiv no. i, xxviii no. 4, xxix no. 3, xxxiii no. 1). From the horizontal bifurcated termination of final Mîm (in *kum*) a double lined ondulating tendril grows up (Pl. xxxiii no. 1). In a stone ornament from the northern minaret such a tendril extends over the whole line.

(2) Ibid. Pl. 12, fig. 2.

(3) Ibid. Pl. xxii 1.

(4) Ibid. p. 46.

(5) Islam vii (1917), p. 156 note 1, 157 note 2.

(6) *S. Flury* referred to *Günzberg-Stassoff*, Miniatures of Hebrew Bibles of the IXth and X th Cent.

(7) K. *A. C. Creswell*, The Muslim Architecture of Egypt III (Oxford 1952), p. 98, fig. 40.

(8) *Ed. Fleury*, Les manuscrits à miniatures de la Bibliothèque de Laon I (Laon 1863), Pl. I.



Fig. 26. Letter from a band of writing in the Hâkim-Mosque
(After S. *Flury*, Ornamente der Hakim-und Ashar-Moschee, fig 2, p. 12).

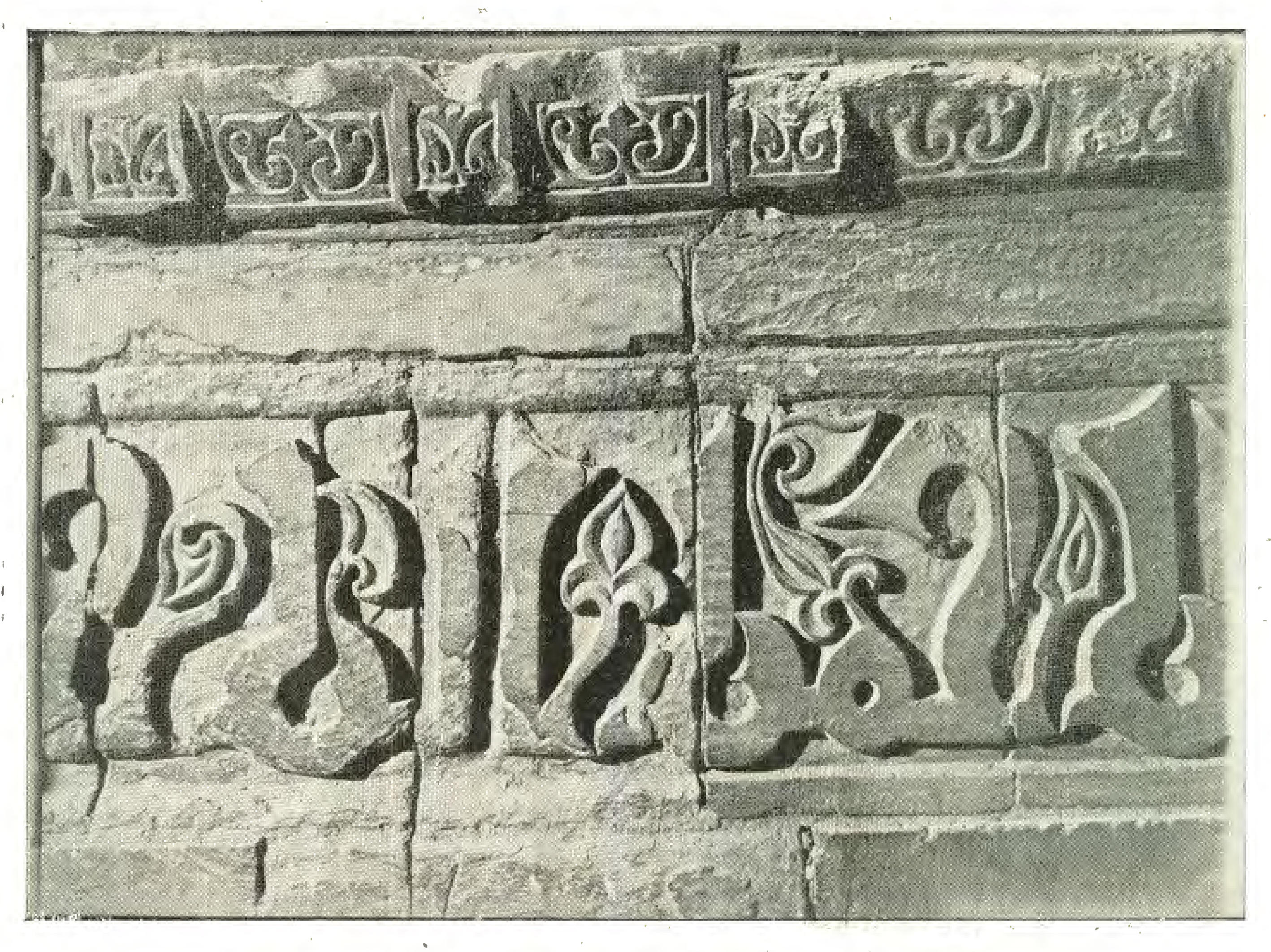


Fig. 27. Band of writing of the socle of the North-Minaret of the Hâkim-Mosque
(After a photograph received from Prof. *K,A.C. Creswell*).

the Greek manuscript of Gregory of Nazianz in the National Library in Paris (Ms. Grec 510, IXth Century A.D., fig. 29) (1), the striking resemblance between the ornamentation of the Arabic and Greek letters is immediately obvious. Did we possess more manuscripts of the period between 728 and 842 A.D., characterized by iconoclasm, more and older material would be available for comparison. Since hesitating attempts to decorate initials with spiral involutions exist already very early, e.g. in the Orosius-codex in Florence of the VIth century A.D. (2) Therefore it could also easily be surmized that similar floral decorations and scrolls, *accompagning* the initials in Coptic manuscripts of the VIII/IXth century A.D. (3) from Akhmîm, had somehow become part of the initials themselves, as it is realy the case in Hebrew manuscripts of the IX/Xth century A.D. (fig. 12) (4).

For the connection of palmette or acanthus-leaf with the letter I should like to refer to another instance, the importance of which has already surprised *van Berchem*, i.e. the inscription of the cistern in Bîr el-'Anêziyya north-west of Ramla (Palestine) on the road to Jaffa (5) (172 A.H., 789 A.D.). We see here in line 4 (fig. 30) a three-lobed palmette growing out of the head of Wâw. *M. van Berchem*—who anyhow suggested that these striking ornaments (cf. line 2 in Bâ) are *independant* from the letter which is *not* correct—is right in saying that this ornament forshadows the rise of coufique fleuri called Carmatian, which appears much later (6). Perhaps he was influenced in his tardy recognition of the realities by his inclination to accept *Marçais*' theory as to the Tunisian origin of floriated Kûfic.

Therefore three neighbouring countries participated decisively in the evolution of floriated Kûfî : Palestine with the first traceable connection of a floral element with a letter (inscription of Ramla 172 A.H.), Egypt, where in the middle of the third century A.H. the decoration of letters with palmettes already has reached a high perfection (cf. fig. 15 and 16) and where the decoration of the

(1) *H. Bordier*, op. cit., fig. 26, p. 88.
(2) Cf. *C. Nordenfalk*, Before the book of Durrow, Acta Archaeologica XVIII (1947), p. 152, fig. 10, 153, fig. 11.
(3) Cf. *W.E. Crum*, Coptic monuments no. 8004, 8007, 8008, 8010, 8012.
(4) Cf. *D. Günzberg- V.Stassoff*, L'Ornement Hébraique (St. Petersburg s.a.) Pl. I and Miniatures of Hebrew Bibles of the IXth and Xth century, Pl. vi.
(5) *M. van Berchem*, Inscriptions Arabes de Syrie, Pl. II.
(6) Les curieux ornements qui les accompagnent sont indépendants du caractères, mais ils font déjà presentir la naissance du coufique fleuri dit carmatique, lequel n'apparait que beaucoup plus tard.

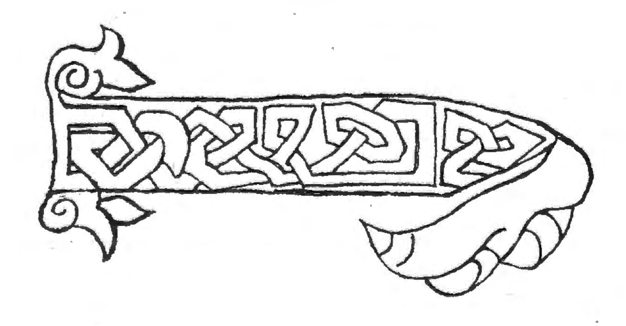


Fig. 28. Initial-Iotain theMs. Grec no. 423 of the Library in Laon (after *Ed. Fleury*, Les manuscrits à miniatures de la Bibliothèque de Laon I, Pl. I).

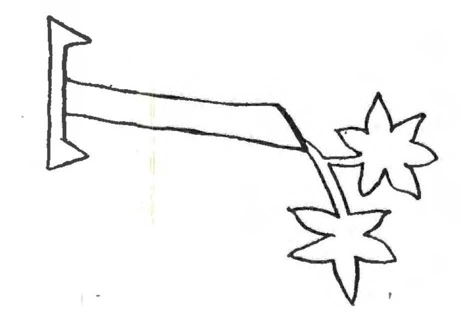


Fig. 29. Initial-Tau in the Ms.Grec no. 510 of the National Library, Paris (After *H. Bordier*, Descriptions des peintures et autres ornements dans les manuscrits grecs de la Bibliothèque Nationale, fig. 26, p. 88).

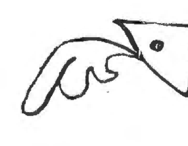


Fig. 30. Wâw with floral decoration in the inscription of al-Ramlah (After *M. van Berchem*, Inscriptions arabes de Syrie, Pl. II).

apices of the letters had been invented possibly in imitation of Coptic forrunners, and the Higâz, where the tombstone of 250 A.H. shows genuine floriated Kûfic definitely established. It was then in Egypt that the first steps to the highest perfection of this new style of writing were made, represented by the inscriptions in the Mosque of al-Azhar and of al-Hâkim bi amr illâh in Cairo. The idea of ornamenting the script, such as we see it in the inscriptions of Amida (426 A.H.), obviously reached Northern Mesopotamia from Egypt. It has been possible to connect the idea of decorating a letter with floral elements with certain initials in Greek manuscripts, then also in Hebrew manuscripts, both belonging to the same sphere of Hellenistic Art which was created in the Near East as from the third century A.D. We know that the school of painters and book-illuminators in Alexandria played a very important rôle not only in Egypt, but also in early book-illumination and illustration in Rome, and spread with Manichaean book-art as far as Mesopotamia, North-Africa and even Turkistân. A direct way leads from this centre of art down to early Islamic book-art—Tûlûnid and Fâtimid—and it also seems very probable that Egypt had a decisive influence in embellishing the Arabic script, whereby Coptic patterns apparently formed a bridge of transition from the late Hellenistic art. For example the developed palmette tendril serving as a marginal frame in the Arabic epitaph no. 3380/12 in the Museum of Islamic Art in Cairo, dated 204 A.H. (819/20 A.D.) (1) recals a similar tendril on a textile of the late Roman period (III rd/IVth century A.D.) from Akhmîm in the Victoria and Albert Museum. (2) So Egypt has much more contributed to the development of Islamic Art than has been hitherto admitted, although it was early recognized that an individual development had taken place here (3). The evolution of the foliated and floriated Kûfic in Egypt gives a new example of the activity of this individual creative power, which willingly accepted and developed inspirations from abroad or from former times.

(1) *H. Hawary-H. Rashed*, Stèles funéraires, I, Pl. xiv.
(2) *A.F. Kendrick*, Catalogue of Textiles from burying grounds in Egypt I (London 1920), no. 183, Pl. xxv, p. 99. Even certain forms of the arabesque already existed in the Vth century A.D., e.g. in a tendril-frame on the arch-way from Bâwît in the Coptic Museum (Inv. no. 6472 A) and in a tendril on a textile from Akhmîm (VI/VII th century A.D.) in *A.F. Kendrick*, op. cit. III (London 1922), no. 838, Pl. xxx, p. 87.
(3) *E. Herzfeld*, OLZ xiv (1911), col. 420.

Oil Possibilities of the West Sinai Foreshore Province (1)

BY

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ABSTRACT

During the last 15 years the intensive exploratory work undertaken by the different petroleum companies working in the West Sinai Foreshore province resulted in the discovery of five new producing areas and in revealing many facts related to the stratigraphical and structural setting of this important portion of Egypt. Stratigraphy and structure, as we know from world wide experience are intimately related to the origin and accumulation of petroleum. In the light of the data now available regarding these two subjects this province could be subdivided into areas having different degrees of possibilities and which are grouped as follows :

Group A : holding greatest oil possibilities and covering 10% of the total area.

Group B : holding lesser oil possibilities and covering 55% of the total area.

Group C : holding questionable oil possibilities and covering 35% of the total area.

Group D : having no oil possibilities and covering less than 1% of the total area.

(1) Communication présentée en séance du 4 avril 1955.

I.—HISTORY OF OPERATIONS

The most important events in connection with the oil development in Egypt during the last 15 years are :—

1) The participation of five major Oil Companies in the exploration of oil, namely : Socony Vacuum, Standard (N.J.), South Mediterranean (Calif.), National and Conrada.

2) The discovery of five producing areas in the West Sinai Foreshore Province, namely Sudr, Asl, Matarma, Feiran and El-Bilaiyim.

3) The passage in 1948 of a new Mines and Quarries Law. The main provisions of this Law are summerized as follows :—

a) Prospecting licenses are to be rectangular with no side less than 5 kilometers and shall not exceed 100 sq. km. (25,000 acres).

b) Prospecting licenses are granted for one year, renewable annually as long as exploration work is executed in a serious manner Renewal beyond the fourth year is dependent on drilling operations being carried on continously.

c) Rents are L.E. 10 for the first year, L.E. 100 for the second and L.E. 25 for each sq. km. for each subsequent year.

d) The holder of a prospecting licence is entitled to a mining lease on half the licence area, at 15% royalty. The lease is to be rectangular in shape and parallel to the boundaries of the licence. Leases are granted only to companies formed in accordance with the Egyptian Companies' Law.

e) In addition to being entitled to lease on half the licence area, the leasee is entitled to lease any part of the remaining area at a royalty of 25%.

f) Duration of the lease is 30 years renewable for a period of 15 years, the royalty upon renewable being 25%.

g) The government has a right to purchase up to 20% of the crude oil produced or products obtained at 10% less than world market prices.

Following the passage of this Law the operating companies, except Conrada, concentrated their work in the known producing region of the Gulf of Suez.

The terms of this Law have been modified early in 1954.

The discovery of the five new producing areas in the Foreshore Province of West Sinai, has contributed very much to the oil production of Egypt (Fig. 1) and occurred after the intensive exploratory work which was carried out by the Anglo-Egyptian Oil Fields Ltd., the Socony Vacuum Company, the Standard Oil Company of Egypt and the National Petroleum Company. This work has involved essentially surface geological mapping, geophysical surveying and core drilling.

The Sudr Oil Field, the first discovery, was made in May, 1946 45 km. to the southeast of Suez, through the continued operations of the Anglo-Egyptian Oil Fields Ltd. and the Socony Vacuum. Company Sudr Well No. 1, drilled to a total depth of 3157 ft., was completed, pumping 367 barrels a day of 22° API gravity oil. Up to the end of 1953 a total of 32 wells resulting in 19 producers were completed. Average depth the producing horizon is approximately 2750 ft. The age of the producing zone is from sands and conglomerates regionally found at the base of the Oligo-Miocene Series, and from Eocene limestone. Several of the Sudr Wells have been good producers, Sudr No. 12, for example, having gauged 4160 barrels daily through a 3/4 inch choke. Daily production from the Sudr field, has recently been in the neighbourhood of 14,000 BPD. The oil is being piped to a loading terminal near the field from which it is shipped by tanker to the Anglo-Egyptian refinary at Suez. Shipments reported to have an average of 14,384 barrels a day.

The second producing field is known as the Asl field located about 65 km. to the southeast of Suez and some 16 km. south of Sudr. This field is located on a lease covering 24,710 acres on which oil was discovered in Asl Well No. 2. This well was spudded in on August 25, 1947 and completed January 26, 1948, at a total depth of 3,910 ft. After acidizing, Asl No. 2 tested initially 3060 BPD of 22° API gravity oil through 2 1/2 inch tubing. The first well on the Asl lease was drilled by the Anglo-Egyptian Oilfields Ltd. at a location one km. north of the discovery well and was eventually abandoned

as a dry hole. All subsequent wells were drilled by the Socony Vacuum Oil Co. Inc., which holds a one-half interest in the Asl field with the Anglo-Egyptian Oilfields, Ltd. owning the other half. The third Asl Well located approximately 400 mt. east of the discovery well was dry. The 4th well, Asl No. 4 located about 400 mt. west of Asl No. 2 was drilled to a total depth of 3384 ft. and also tested approximately 3000 BPD. through open tubing. Asl No. 5 was located 400 mt. south of Asl No. 4. This well created a considerable stir in the press and the region was compared with the great fields of Saudi Arabia and elsewhere in the Middle East. Actually the large figure was on the basis of an open flow for a very short time. Tested through a 7/16 inch choke the well showed a producing capacity of 1615 BPD. It is thus comparable to a number of wells in Sudr. Until the end of 1953 a total of 29 wells were drilled in Asl field with 12 producers. The Asl production is mostly from the Eocene Limestone beneath the Oligo-Miocene unconformity and therefore similar to Sudr (The producing zone is locally known as the "Weathered Eocene Zone".) The average depth to the producing formation varies between 2870 ft. and 3870 ft. A six-inch pipeline, about 17 km. long was laid from the Asl field to connect it with loading facilities of the Sudr field.

The third producing area is known as Matarma and is situated between Asl and Sudr. The Matarma field is now operated by both the Anglo-Egyptian Oilfields and Socony Vacuum Companies, and was discovered in 1948. Up to the end of 1953 atotal of only 6 wells were completed in the Matarma field with 3 producers. This field is not fully tested yet. So far, production is there obtained from a sand bed in the Oligo-Miocene formation. This bed (locally known as the Asl Zone) may correspond to a sand bed approximately 1000 ft. above the base of the Oligo-Miocene reported from Asl' Well No. 2 at a depth of 3334 ft. The oil is 18° API gravity, heavier than the production from Asl and Sudr.

The Wadi Feiran field, the fourth producing area is located approximately 150 km. to the southeast of Suez. This area was discovered by the Standard Oil Co. of Egypt early in 1949. The discovery well, Feiran No. 1, produced on test an average of about 120 BPD of 23° - 25° API gravity oil through a quarter-inch choke. Standard spudded in the well on August 19, 1948 and drilled to basement at 6627 ft. Electric logs indicated possible production at about 6570 ft. and tests of this interval were made. Producing horizon

has been identified as sands in the "Globigerina marls" of Oligo-Miocene age. These sands may also correspond to the sands of the "Asl Zone". Development of this discovrey has been suspended for almost five years pending the settlement of the terms of licences and leases under the Mines and Quarries Law of 1948. Early in 1954 the National Petroleum Co. was granted the right of operating the Feiran Field, and located the second test well approximately 500 mt. west of the discovery well. Feiran No. 2 was drilled to a total depth of 8026 ft. and tested about 900 BPD through open tubing. Similar to Feiran No. 1, production is obtained from 20 ft. thick sandstone bed in the "Globigerina marls" (Oligo-Miocene). Feiran No. 3 was located to the SE of Wells No. 1 and 2 (Lat. 28° 42' 39". 77 N, Long. 33° 14' 44".64 E). This well was completed as a dry hole at a depth of 376 ft. Feiran No. 4 located very closely to Well No. 2 to the SE (Lat. 28° 43' 10".66 N, Long 33° 13' 7".33 E) is still under operation.

El Bilaiyim, the fifth producing locality in West Sinai was discovered early in January 1955. The site is situated approximately 10 km to the south of the Feiran Oil Field. Only one well was completed at El Bilaiyim with a production of good quality oil from a sand bed in the "Globigerina Marl" formation. This well was drilled to a total depth of 7420 ft. El Bilaiyim area is still under test.

Prior to the discovery of the above mentioned producing areas liquid oil was produced on a small scale from the Abu Durba Oilfield, (Fig. 2), lying approximately 180 km. to the SE of Suez. Abu Durba well No. 1 yielded a total amount of 400 tons (about 2500 barrels) of oil from Recent sands at a shallow depth of 140 ft. The early operations in this field were undertaken by the Egyptian Government where 10 shallow wells (No. 1-10 inclusive) were drilled wih an average depth of about 500 ft. Drilling commenced on June 1, 1918 and was terminated by the Government late in 1922. This work resulted in the discovery of 3 producers (No. 1, 5 and 7). The field was then operated by the Egyptian Oil Syndicate from September 1, 1923 to 1939. The Egyptian Oil Syndicate cleared many of the old wells and drilled up to 1930, 19 more wells with an average depth of 500ft. Abu Durba concession was then taken by Misr Bank where was production was obtained from the already existing wells. This process continued for approximately 6 years when production from the field was almost stopped in 1945. The cummulative production of

the Abu Durba field amounts to 11,835 metric tons (73,969 barrels) (Fig. 3). Abu Durba oil is heavy and asphaltic, and shows a waxy resin which is thought by Bowman (1925) to be an indication of originating from a lighter oil. Main producing horizon has been identified as sands belonging to the Cretaceous (Nubian type Sandstone). According to the recent work done by Standard these sands are younger in age and were assigned the post-Miocene.

The following table shows the oil production and producing wells in the West Sinai Foreshore province :—

Field	Operator	Year of Discovery	Proven area Sq. Km.	Total producers	Cumulative Production through 1953 (Barrels).
Abu Durba	Egyp.Government and EPS.	1918	0.25	Several	73,969 (abandoned)
Sudr	AEO 50% and SVO 50%	1946	5.00	18	22,782,409
Asl	AEO 50% and SVO 50%	1947	3.50	12	22,239,097
Matarma	AEO 50% and SVO 50%	1948	?3.0±	3	Under test
Feiran	SOE and NPC	1949	?2.5±	2	,, ,,
El Bilaiyim	NPC	1955	?	1	,, ,,

From this table it is seen that the producing areas so far discovered in the West Sinai Foreshore province occupy only a minor portion of the prospective area of the Gulf of Suez region (Fig. 4).

II.—PETROLEUM OCCURRENCES

In the West Sinai Foreshore province petroleum occurrences are not restricted to the above mentioned localities, but seepages were recognized from several other places, mainly at Tanka, to the east of Abu Zenima and at Nezzazat. Attempts have been made since 1910 to develop these occurrences, but were almost all failure.

The relative geological position of the West Sinai main petroleum occurrences are summerized in the following table :

Area	Location	Main Horizons	Age	Nature
East Suez Canal	Between el Shatt and el Qantara	Shale containing gas.	Schiler	Poor.
Abu Qitifa	35 km SE Suez	Green marls; oil and gas shows	Schlier	Poor
Sudr Field	45 km SE Suez	*a*) Conglomerate *b*) Weathered limestone	Oligo Miocene Eocene	Prolific ,,
Matarma field	56 km SE Suez	*a*) Porous sandstone *b*) Weathered limestone	Oligo-Miocene Eocene	Not very rich Prolific
Asl Field	65 km SE Suez	*a*) Porous sandstone (Asl Zone) *b*) Conglomerate *c*) Weathered limestone	Oligo-Miocene Oligo-Miocene Eocene	Not very rich Prolific ,,
Gharandel	88 km SE Suez	Clay and sandstone	Upper Eocene	Only traces
Tanka	110 km SE Suez	Marls and sandstone	Upper Eocene	Good traces
Matulla	120 km SE Suez	Marls and sandstone	Upper Cretaceous	Only traces
Nezzazat	147 km SE Suez	Sandstone and Clay	Lower Cretaceous	Traces
Feiran Field	150 km SE Suez	Sandstone	Oligo-Miocene	Prolific
El-Bilaiyim	160 km SE Suez	Sandstone	Oligo-Miocene and Miocene	Prolific
Abu Durba	180 km SE Suez	Sandsonte	Post-Miocene	Not very rich
RasMohammed	295 km SE Suez	Sand and gravel	Post-Miocene ?	Traces

These occurrences divide themselves broadly into five horizons which are from top downward :—

5) Post-Miocene horizons, particularly represented at Abu Durba, are not highly prolific and yield oil of poor quality (heavy and asphaltic).

4) Middle Miocene horizons and are known at el Bilaiyim.

3) Oligo-Miocene horizons involving both the "Asl Zone" and the Conglomerate at the base of this series. These zones are very much prolific and are contributing largely to the oil production of this province.

2) Eocene horizons, mainly the weathered limestone at the junction with the overlying Oligo-Miocene formation. This horizon is very prolific especially at Asl and Sudr.

1) Pre-Eocene horizons, mainly the Upper Cretaceous ones. So far these horizons have not contributed to the oil production of West Sinai.

III.—ORIGIN OF PETROLEUM

The question as to the origin of petroleum occurrences in West Sinai and of all the other occurrences in the world is strongly contested. In his unpublished work on "Basin and Oil occurrences" Mr. L.G. Weeks (Basin study geologist, Standard Oil Comp. N.J.), wrote "Nature has concentrated the bulk of her supplies of oil as she has done for other minerals in relatively few areas; the remaindr she has scattered in many places". Analysis of the oil occurrences (volume of oil per unit of time and per unit of area and volume of sediments) is closely related to two basic and closely interrelated factors :— 1) the genetic type and architecture of the basin and 2) primary conditions on the bottom of deposition. In this report Mr. Weeks, lists many of the favourable conditions for oil generation and accumulation. Commenting on this, Mr. G. M. Knebel, (Chief geologist, Standard Oil Co., N.J.) wrote "The following of and use of these guides will result in new individual discoveries and new oil producing areas or trends. Yet often with all the favourable criteria met, we fail to find oil. We knew much of the habit of oil, but we have to admit still that we can't tie down the exact origin of oil. Source beds for oil have probably not been under continuous deposition throughout since the Cambrian. Certain periods were just right in Pennsylvanian, Jurassic, Cretaceous, Miocene times etc. can't we find out what these conditions were was it 1) a very uniform or extremely variable climate resulting in very stable or extreme currents in atmosphere or aquasphere ?, 2) a radical change in the composition of the atmosphere or aquasphere ? We know generally that an increase in CO_2 results in greater production of proteins in certain life forms in the sea., 3) volcanic activity or lack of it ? 4) the result of greater concentration of radioactive material at certain periods ? 5) due to shifts in the polar areas of the earth ?, 6) due to increases or decreases in rotating speed of the earth ?, 7) due to changes in the types of rayes being given off by the sun ?, 8) the periodic appearance of types of living organisms capable of producing and maintaining large amounts of hydrocarbons in their cell structure ?" ...... etc.

The discussion of the oil resources of the West Sinai Foreshore Province and of the entire Gulf of Suez region is a fairly wide subject which can be dealt with in several ways. Without going into details the following is a method of approach which is based on two fundamental facts :—

No. 1—The physical properties of samples of crude oil collected recently from Hurghada, Gemsa, Gharib fields (West Coast Gulf of Suez),. Abu Durba and Sudr fields (East Coast Gulf of Suez) were studied in USA in the ESSO Research Laboratories and it was found that these samples appear to be quit similar in composition. It has accordingly been suggested that the oil of these different localities could be from the same source eventhough their reservoirs are of Post-Miocene (Abu Durba), Oligo-Miocene (Hurghada, Gharib, Sudr etc.), Eocene (Sudr), Cretaceous and Carboniferous (Gharib).

No. 2 All the oil seepages and the oil fields are found along the margins of the Gulf of Suez or on islands and reefs within it.

By using these two facts we may be justified in assuming that the source of the Gulf of Suez oil is from beds burried in the deep troughs occurring either under the gulf water or along its margins.

The question now arises, what could these beds be ? The Globigerina Marls of Oligo-Miocene age are regarded by almost petroleum geologists to be the source of the major part of the oil so far produced from the Gulf of Suez region. This is obviously because these beds are very rich in protozoan organisms and also because they were probably rapidly formed.

In places within the Gulf of Suez region where the beds constituting the Globigerina Marl Series are in contact with porous beds either by normal laterial gradation or along the system North west-Southeast of faults (major tectonic trend in this region) oil is always expected.

The mechanism of the accumulation of oil would be simply that it moved up or that it is squeezed up from the mother rock thickly developed in the adjacent deep troughs and preserved in the porous beds found mainly along and below the Oligo-Miocene unconformity. The following diagramatical sketches (Figs. 5, 6, 7, 8, 9, 10) illustrating the structure of some of the known oil fields of that region give a clear proof of the present hypothesis. The origin of the good "oil show" reported from the Tanka wells could also be interpreted in the same way (Fig. 11).

The successful application of this hypothesis to the location of new oil fields has been found difficult as demonstrated by the excessive ratio of dry wild cats to discovery wells (average 1 : 20). This is essentially because the source beds may not have been uniformly deposited throughout the whole length and breadth of the Gulf of Suez region. Of course even when this factor is maintained oil is not always found firstly because the well location may not be properly selected and secondly because there may have been insufficient cover rock or there may have been much faulting allowing any preserved oil to leak out.

IV.—SUBDIVISION OF THE WEST SINAI FORESHORE PROVINCE

In discussing the relationship between the presumed different factors governing the origin and accummulation of petroleum and the general basin and structural setting of the West Sinai Foreshore Province we find that it could be classified into areas having different

degrees of possibilites and which are grouped as follows (Plate 12).

Group	A	holding	greatest oil possibilities.
,,	B	,,	lesser oil ,,
,,	C	,,	questionable oil ,,
,,	D	having no oil possibilities.	

Group A.

Including the following areas :—

1) The coastal strip extending from Ras Mesalla Wells southward to Lagia Wells. This strip is 80 km. long and has an average width of 10 km., and occupies an area of 600 sq. km. which is about 7.5% of the total area of the West Sinai Foreshore province. Within the limits of this ribbon are found three producing localities (Sudr, Asl and Matarma) and were drilled 21 deep wells (excluding those located in the oil fields) with a total fotage of 79,852 ft.

2) Baba-Sidri plain extending from Abu Zenima southward to Nezzazat, i.e. a distance of 21 km. The Maximum width of this plain is almost 7.5 km. It occupies an area approximately 85 sq. km. which is about 1% of the total area of the West Sinai Foreshore Province. No production has so far been obtained from this locality, but it contains excellent burried structures which are now tested by the National Petroleum Co. Within this plain three deep wells, namely SOE, Rudeis No 1, NPC Sidri No 1 and Baba No 2; and two shallow coreholes (Baba No. 2 and 6) were completed with a total fotage of 29,250 ft. The NPC Baba well No. 2 is the deepest well drilled in this particular area (Total depth 11250 ft. = 3430 mt). This well drilled the thickest "Globigerina Marl" section, so far recorded in West Sinai.

3) Feiran Plain extending from Nezzazat southward to the northern extremity of the Abu Durba granitic range i.e. a distance of 25 km. Maximum width of this area is a little over 5 km. This plain occupies an area of about 65 sq. km. which is less than 1% of the total area of the West Sinai Foreshore Province. Within this plain is present the newest producing localities so far discovered in Egypt, namely Feiran and El Bilaiyim Fields. In addition to the test well drilled there in 8 shallow coreholes were completed with a total depth of about 12,500 ft. These shallow coreholes are restircted to the northern portion of this particular area.

The above mentioned 3 localities which occupy a total area of 750 sq. km. hold, as stated before, the greatest oil possibilities of the West Sinai Foreshore province. This is essentially because :—

I. Structures (both surface and subsurface) have been proved in them. None of these structures is a true anticline, they are mostal to faulting with closures developed either on the upthrown side of the fault e.g. Sudr, Asl and probably also Matarma or with closures developed on the downthrown side of the fault e.g. Feiran and El Bilaiyim.

II. Liquid oil has been proved within two of these localities and traces were recorded from the third one. The strong salt water struck in NPC Sidri well No. 1 has been taken as an indication of the occurrence of good oil somewhere in the vicinity of this well.

III. The "Globigerina Marl Section" is well developed in these areas and has a maximum recorded thickness of 6300 ft. (1920 mt.) at Baba. Further drilling will undoubtedly prove the occurrence of other greater thicknesses of the "Globigerina Marl Section" in these three localities (This assumption is based on the study of isopach maps).

IV. Effective porosity in these areas is quite permanent, being well developed either in the Oligo-Miocene Section (the Asl Zone and the Conglomerate series at the base of the formation) or in the Eocene below (Weathered Limestone). Although not proved yet in the southern two areas drilling now undertaken by the NPC will throw much light on the distribution of this latter horizon i.e. the "Weathered Eocene Limestone".

V. Eventually the "Lagoonal Series" of Middle Miocene age, regionally forming a uniform blanket overlying the Oligo-Miocene beds below, affords a good cover rock for any oil accumulations occurring in these three areas.

Group B.

Including the following areas :

1) The East Suez Canal — Abu Qitifa area extending from the latitude of El Qantara southward to the northern extremity of Gabel Hammam Faraun i.e. a distance of 170 km. From the east this area is mainly bounded by the series of major rift faults marking the eastern edge of the main "graben". It occupes an area approximately 4000 sq. km. which is about 50% of the whole province. In this large area only four wide spread wells were completed (Habashi No. 1, Ayoun Musa No. 1 and 2, and Abu Qitifa No. 1) with a total fotage of 15,563 ft.

This area has some similarities to the other areas of Group A particularly from the structural point of view. Several structures are known and are represented by a series of surface anticlines These are examplified by :—

I. Lake Timsah, Hebeita el Tasa and Habashi lying at a short distance to the east of the Suez Canal and the Bitter Lakes Region (these were discovered by the author in 1947).

II. Gebel Murr lying to the east of Suez.

III. Abu Qitifa lying about 35 km. to the southeast of Suez.

Burried huge gravity anomalies which are examplified by Ayoun Musa lying at a short distance to the southeast of Suez, and Katib Um Hamas to the east of the Bitter Lakes. are also known in this area.

On the other hand the East Suez Canal — Abu Qitifa area differs from the other areas of Group A in that :—

a) The "Globigerina Marl sections" do not attain much thicknesses and show an abundance of littoral and reefal facies. The following is a very rapid review of some of the typical sections exposed and drilled and which are arranged from north-southward :—

Habashi area	...446 mt.
Ayoun Musa area	...100 mt. (incomplete)
Abu Qitifa area	...571 mt.
Bir el Haleifiya — G. el Zeita area	...671 mt.

From the study of the series of isopach maps made by the SOE it was noted that the general attitude of the "Globigerina Marl Section" is to show a thinning phenomenon to the north and

towards the edges of the Suez Garden. It seems, therefore, that the marl series in this particular area (at the margins of the graben and to the north of Suez) had no chance to become deeply burried after depositoin. Their value as a source rock is, therefore, much reduced. Adding to this, adequate cover or cap rocks are almost unknown from the main part of this area which lies to the north of Ayoun Musa.

b) Liquid oil has not been proved within this wide area; only a few slight "gas shows" were reported from Habashi and oil impregnations from Abu Qitifa. Several rock samples were collected from the "Globigerina Marl Section" exposed at Bir el Haleifiya - G. El Zeita area, which lies in the southern extremity of this region and were treated with ether. A faint yellow coloration was occasionally obtained which may indicate the possible occurrence of traces of hydrocarbons.

Although the Oligo-Miocene section deposited in this portion of West Sinai does not seem to offer positive petroleum possibilities we have to consider the importance of the thick pre-Miocene sections which are expected in the northern portion of this area. The Lower Cretaceous, the Jurassic and probably also the older series would have excellent possibilities. Also the presence of an oil show in the Pliocene of the Abu Roash Core Hole No. 3 suggests that the Pliocene deposited in this area may be productive.

2) The very narrow coastal strip bounding the Gabel Hammam Faraun - Matulla range from the west and which extends from the southern extremity of the Mesalla-Lagia area (A1, plate 12) to the northern extremity of the Baba-Sidri plain (A2, plate 12). Its length is a little over 30 km., the width is generally less than 500 mt., but near Abu Zenima town it becomes at least 2.5 km. This strip occupies an area of about 20 sq. km.

In this area, were initiated in 1910 the first petroleum operations undertaken in West Sinai. These were concentrated at Gebel Tanka approximately 110 km. to the southeast of Suez. At G. Tanka were completed 3 shallow wells with a total fotage of 5732 ft. No other wells were drilled in this strip.

The G. Tanka area was selected for drilling on account of the excellent oil seepages occurring there and also because of its favourable structural conditions. In the 3 wells drilled there liquid oil was struck at shallow depth in the Upper Eocene formation and in Wells No. 1 and 2 traces of oil were also reoported from lower horizons in the Upper and Lower Cretaceous but the site was abandoned as no commercial production was obtained from it.

According to Bowman (1926) the origin of the Tanka oil is Cretaceous and Eocene in age. Another interpretation coinciding with the above described theory and which is acceptable to the writer could be made. According to this, oil originated in the Globigerina Marl Sections burried in the deep trough underlying the Gulf water; it was subsequently squeezed up from the mother rock along the fault plane and accumulated in the porous horizons developed in the Cretaceous and the Eocene formations (Fig. 11).

This strip contains many of the salient features which would make it a first class prospective territory, but its narrowness and the possible existence of the favourable structural sites outside it to the west, underlying the Gulf water, make us regard it of secondary importance. The possible discovery, however, within the limits of this strip of any structural closure on the down thrown side of the major rift fault which bounds it from the eastern side may make of it an interesting producing locality.

3) The narrow and elongate coastal strip extending from the southern extremity of the Feiran plain (A3, plate 12) to approximately 20 km. to the northwest of Ras Mohammad. From el Tor northwestward, this strip is very narrow; its width from the coast to the foot of the Gebel Araba - Gebel Abu Durba granitic range is generally less than 500 mt., on the other hand to the southeast of el Tor, the average width of this strip is 4 km. and it is bounded from the east by amajor fault, the position of which is proposed from the gravitymeter work done there. The length of this coastal strip is about 100 km. and it occupies an area of about 200 sq. km. which is 2.5% of the whole province.

Within this area there exists the old Abu Durba Oil field (plate 2) and were drilled 3 shallow core holes, namely SOE El Bilaiyim No. 1 and SOE Abu Durba 1 and 2 with a total fotage of 4254 ft. Other

wells are now drilled by the NPC around the Abu Durba Field. The old and new operations are all restricted to the far northwest portion of this strip.

Liquid oil has been produced from the Abu Durba area from the post-Miocene porous sands and gravels. Abu Durba Oil Field is of secondary importance compared to the other producing areas in West Sinai. Fig. 9 is a rough sketch illustrating the origin of the Abu Durba Oil. As elsewhere the thick "Globigerina Marl" Sections burried in the deep trough underlying the Gulf of Suez water act as a source for this oil which is thought to percolate upward along the major rift fault bounding the Abu Durba granitic range from the west, side to get accumulated where porosity is developed in the post-Miocene section. Further production could be obtained from the Abu Durba area if deep bores are put down to come to the "Globigerina Marl Section" itself.

The author is not familiar with the detailed structural configuration of this coastal strip. However, he recalls that the seismic surveys done by the SOE there have revealed minor features. In his opinion, these features, when tested, would contribute much to the oil production of West Sinai. Possible producing horizons would be confined to the Oligo-Miocene series (Globigerina Marls) and to the post-Miocene formations. Pre-Miocene horizons, mainly the "Weathered Limestone" of Eocene age may not be as well developed as it is the case in the other areas to the north i.e. at Sudr, Asl and Matarma.

Group C.

This includes the following areas :

1) The mountainous region which involve both the G. Hammam Faraun-Matulla range and the relatively high country lying immediately to the east and to the northeast. This area is bounded from the east by a series of rift faults which mark the eastern limit of the main graben; From the west it is also bounded by another line of parallel faults coinciding approximately with the gulf coast line. The maximum length of this area is about 65 km. and the maximum width is 25 km. The total area of this portion of West Sinai is approximately 800 sq. km. and is occupied essentially by Eocene and

Cretaceous starta which are very much ruptured owing to the occurence of a successive series of parallel faults.

In this area were drilled only 3 shallow wells at Matulla with a total fotage of 2812 ft. These wells are restricted the southern portion of this area. The site was selected for drilling on account of its favourable structure and also because of the oil seepages which are present there. The result of drilling was the discovery of several oil horizons in the Cretaceous strata. The carbonaceous shales of Cenomanian age are looked on by many petroleum geologists as a probable source of this oil.

Little is known to us about the petroleum possibilities of this portion of West Sinai, but the results of drilling seem to indicate that the Cretaceous may be productive in this particular area. But even so the amount of possible production would be very limited owing to the excessive faulting of the area and also the absence of favorable structures.

2) Wadi el Qaa trough area which extendis from the SOE Baba Well No. 1 in the north to the AEO Ras Mohammad Well No. 1 in the south.The length of this area is 170 km. from northwest to southeast and the maximum width, to the east of theAbu Durba granitic range, is 30 km. It occupies an area of the 2500 sq. km. which is about 25% of the whole province. On the east the Wadi el Qaa trough Area is bounded essentially by South Sinai granitic ranges. The boundary between these ranges and the area concerned is certainly fault governed. The northern portion of this area is mainly occupied by Cretaceous and Tertiary rocks, which are dissected by a large number of NW-SE faults. The southern portion is for the most part a gravel covered plain. The gravels form a mere superficial layer overlying the succession from the "Nubian Sandstone" to the "Miocene Lagoonal Series". Several outcrops of granite are known from the southern extremity of this area.

This wide area has the general feature of a basin which is filled with Miocene and Oligo-Miocene strata overlying Eocene and Cretaceous beds. The thickness of the pre-Miocene section could be estimated from the study of the exposures on the east flanks of the Abu Durba - Abu Huswa granitic ranges. The amount of Miocene

and Oligo-Miocene fill cannot be reasonably foretold as this area has not been tested properly by deep boring. Towards Ras Mohammad in the south there is a possibilitity that the Miocene and the Oligo-Miocene strata are resting directly on the Basement Rocks, (the Cretaceous and the Eocene rocks might have been totally or partly removed owing to intensive erosion which took place during the Oligocene times).

On a compiled gravitymeter map made by SOE, this area is occupied by a huge gravity-low which trends NW-SE. The magnetic picture of this same area agrees in general with this feature but there are local variations probably due to variations in the basement relief in the subsurface.

Only two wide spread wells were drilled in this area. The SOE Baba Well No. 1 located in the northern extremity of this area was made to test a small closure on the upthrown side of one of the NW-SE faults. This well drilled 4501 ft. of sedimentary section (Upper and Lower Cretaceous, and Carboniferous) before it hit the Basement Complex. No free oil or gas were reported from this well. The AEO Ras Mohammad Well No 1. was located in the southern extremity of the area. According to Bowman (1926) the site was selected for drilling on account of its established "anticlinal or rather domal structure" and also because the stratigraphic succession anticipated was thought to offer some possibilities. According also to Bowman "The presence of Pliocene beds, with *Tellina lacunosa*, overlying shales with gypsum, let the Company hope that the latter beds were of Miocene age, and that here the normal Miocene succession, as developed in the lower part of the Gulf of Suez, would prove to be present". This well was rather shallow (1328 ft. or 405 mt) and struck only traces of oil at the depth of 334 - 350 ft. This unhappy result might have been due to the unfavourable structural position but it has been established from the SOE work that the Basement Rocks should be present at a shallow depth.

From as much information as now available, the author does not know exactly whether it would be justified if we assume that this area holds positive oil possibilities. The problem is essentially a structural and a stratigraphic one. As regards the first side of the problem we admit that although the general setting of this area

is fully understood, yet plenty of the details concerning the subsurface structural pattern are still unkown. This problem would be solved by carrying out further exploratory work which should include detailed and thorough seismic surveys. The other side of the problem i.e. the stratigraphic one, should await the further test drilling without which we would not be able to state how much of Miocene and post — Miocene fillings are present in the center of the trough area.

Group D.

This includes the two granitic ranges, namely Abu Durba (D_1 plate 12) and Abu Huswa (D_2 plate 12) which are situated in the southern half of the West Sinai Foreshore province. These two ranges are almost 35 km. long and 2 km. wide. They occupy an area approximately 70 sq. km. which is about 0.7% of the total area of West Sinai. This area has absolutely no oil possibilities.

LIST OF ABBREVIATIONS

AEO	:	Anglo-Egyptian Oilfields.
API	:	American Petroleum Institute.
BPD	:	Barrels per Day.
Calif	:	California.
COOP	:	Cooperative Society of Petroleum.
E	:	East.
EPS	:	Egyptian Petroleum Syndicate.
ft	:	foot.
Km	:	Kilometre.
N.J.	:	New Jersy
NPC	:	National Petroleum Company
SE	:	Southeast
Sq.Km	:	Square Kilometre.
SOE	:	Standard Oil Company of Egypt
SVO	:	Socony Vacuum Company.

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Fig. No. 3

COMPIETE PRODUCTION CHART
OF
ABU DURBA FIEID
(1921 - 1945)

1500
1000
500
000

1920 1925 1930 1935 1940 1945

Y E A R S

32° 00 33° 00' 34° 00'
30° 00'
29° 00'
28° 00'
27° 00'
33° 00'

Ismailia
G. Bitter Lake
L. Bitter Lake
SUEZ
SUDR OIL FIELD
RAS MATARMA OIL FIELD
ASL OIL FIELD
SINAI
GULF OF SUEZ
Abu Zenima
Feiran Field
El Bilaiyim
Abu Durba
ABU DURBA OIL FIELD
EASTERN
DESERT
RAS GHARIB OIL FIELD
Tor
G. ZEIT
Esh Mellah Range
RAS GEMSA OIL FIELD
Tawila Is.
STRAIT OF GUBAL
Shadwan Is.
Ras Mohammad
Abu Shaar
RED SEA
HURGHADA OIL FIELD
Dishet Abu Mingar
Dishet el Dhabaa
Sherm el Arab

Fig. No 4
Showing prospective area of Gulf of Suez Region

0 20 60
Scale in Km.

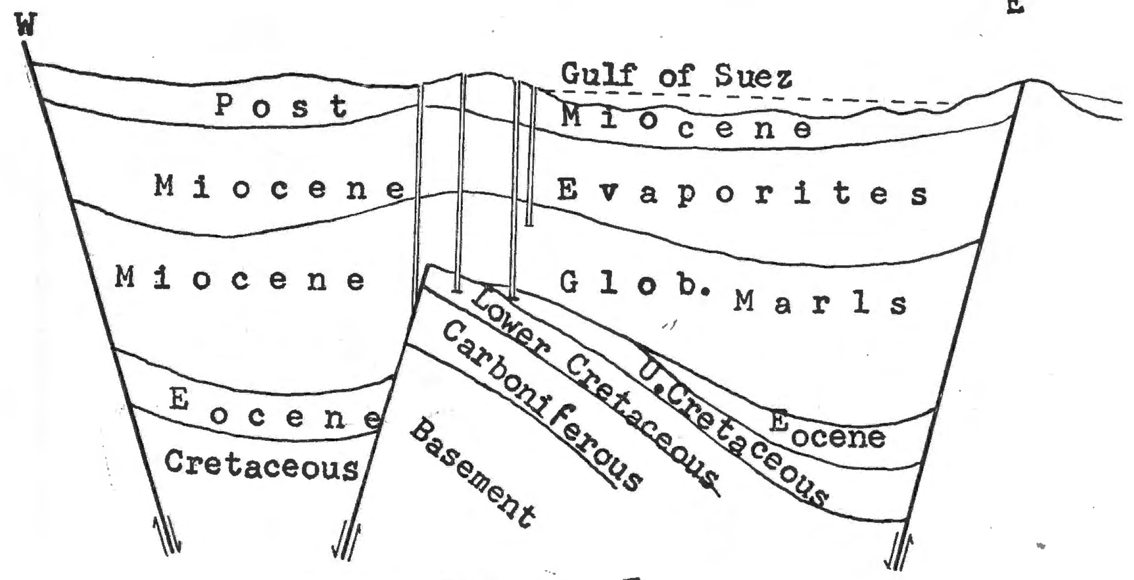


Fig. No. 5
DIAGRAMMATICAL SKETCH
Of
Ras Gharib Oil Field

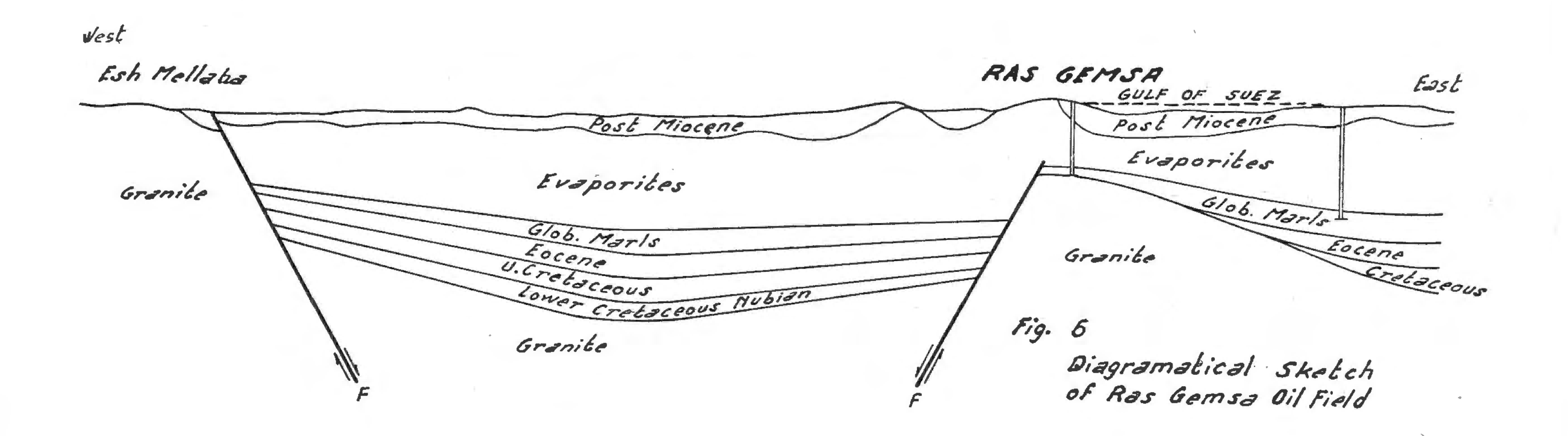


Fig. 6
Diagramatical Sketch
of Ras Gemsa Oil Field

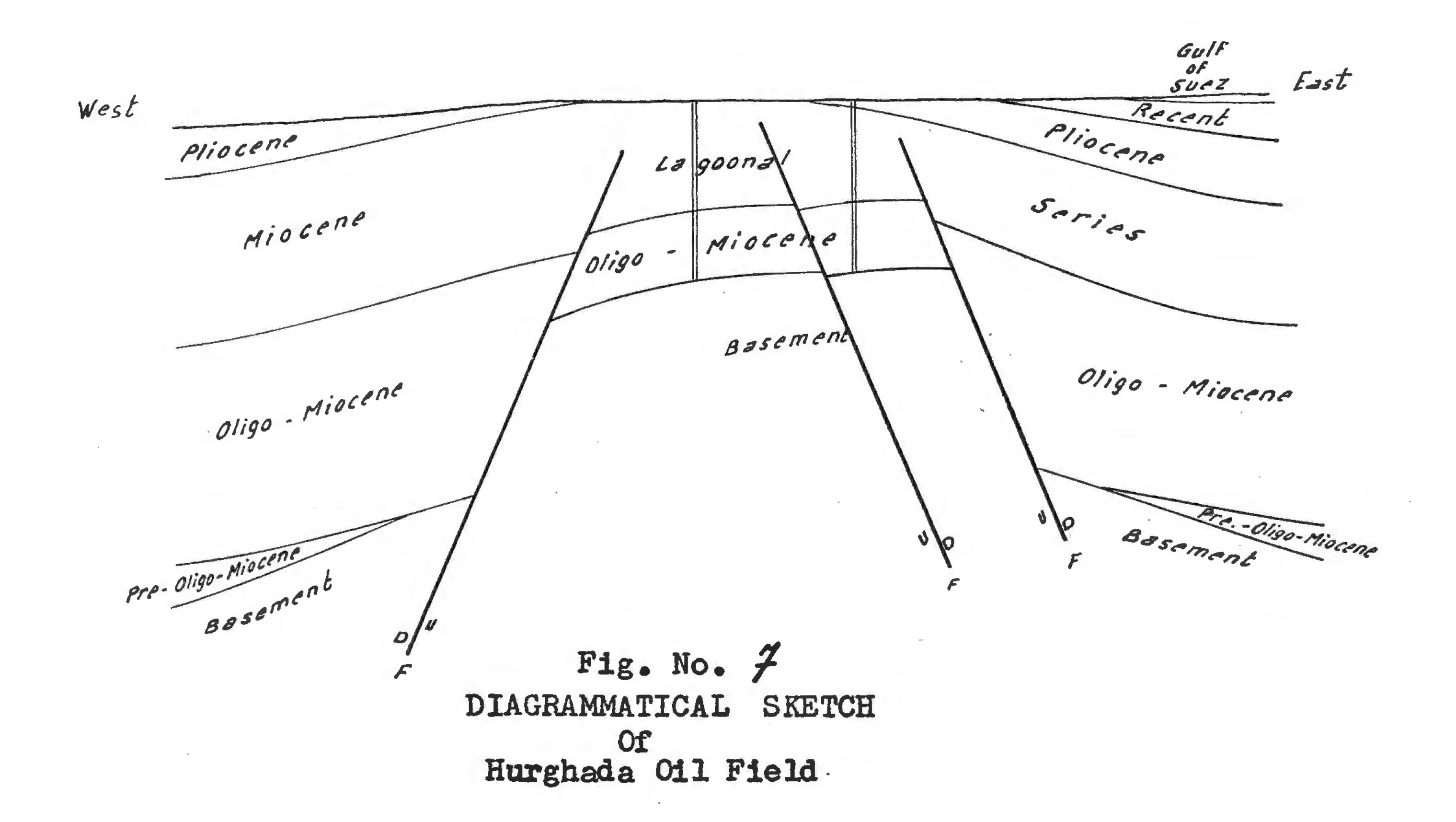


Fig. No. 7
DIAGRAMMATICAL SKETCH
Of
Hurghada Oil Field

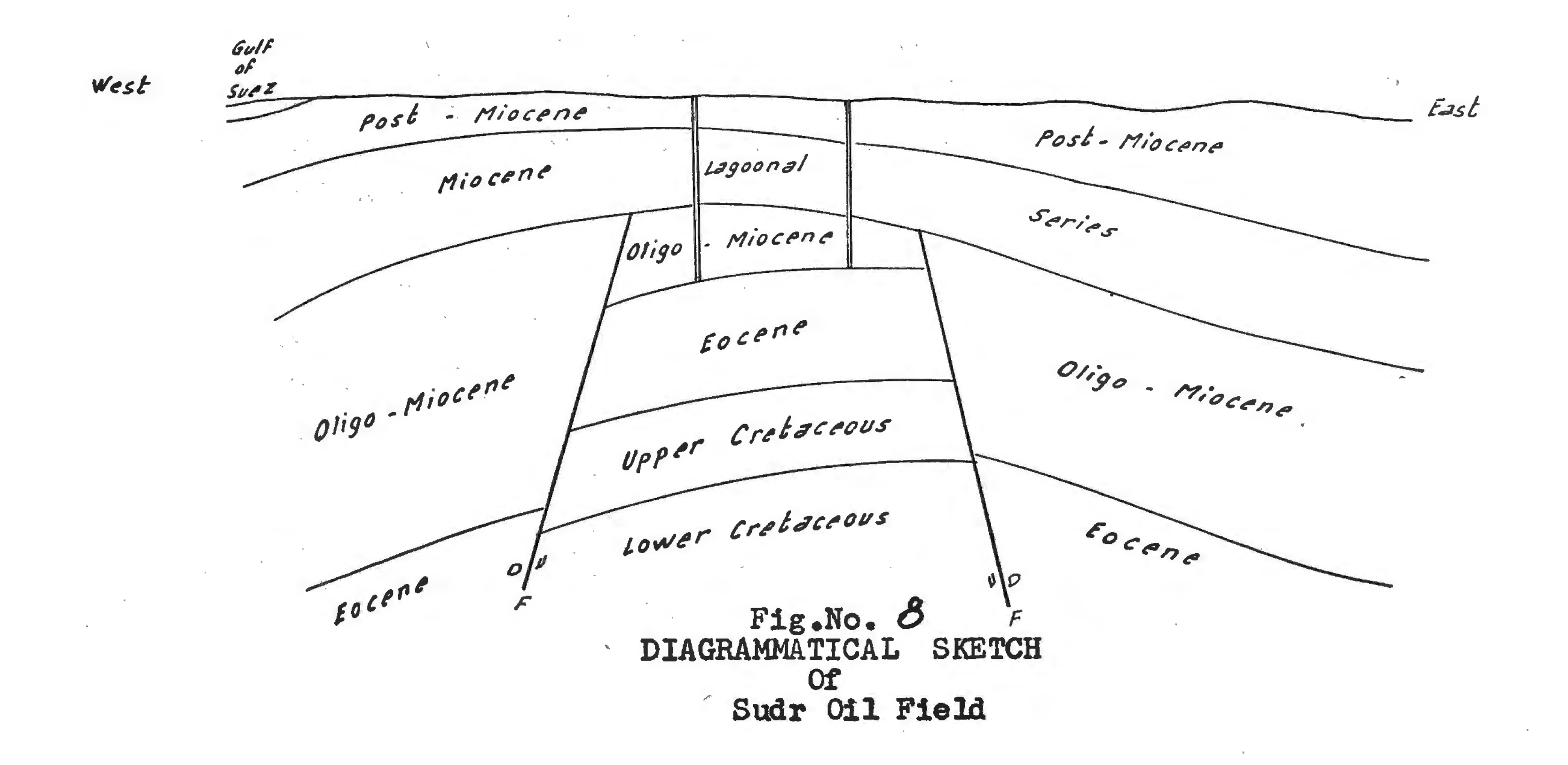
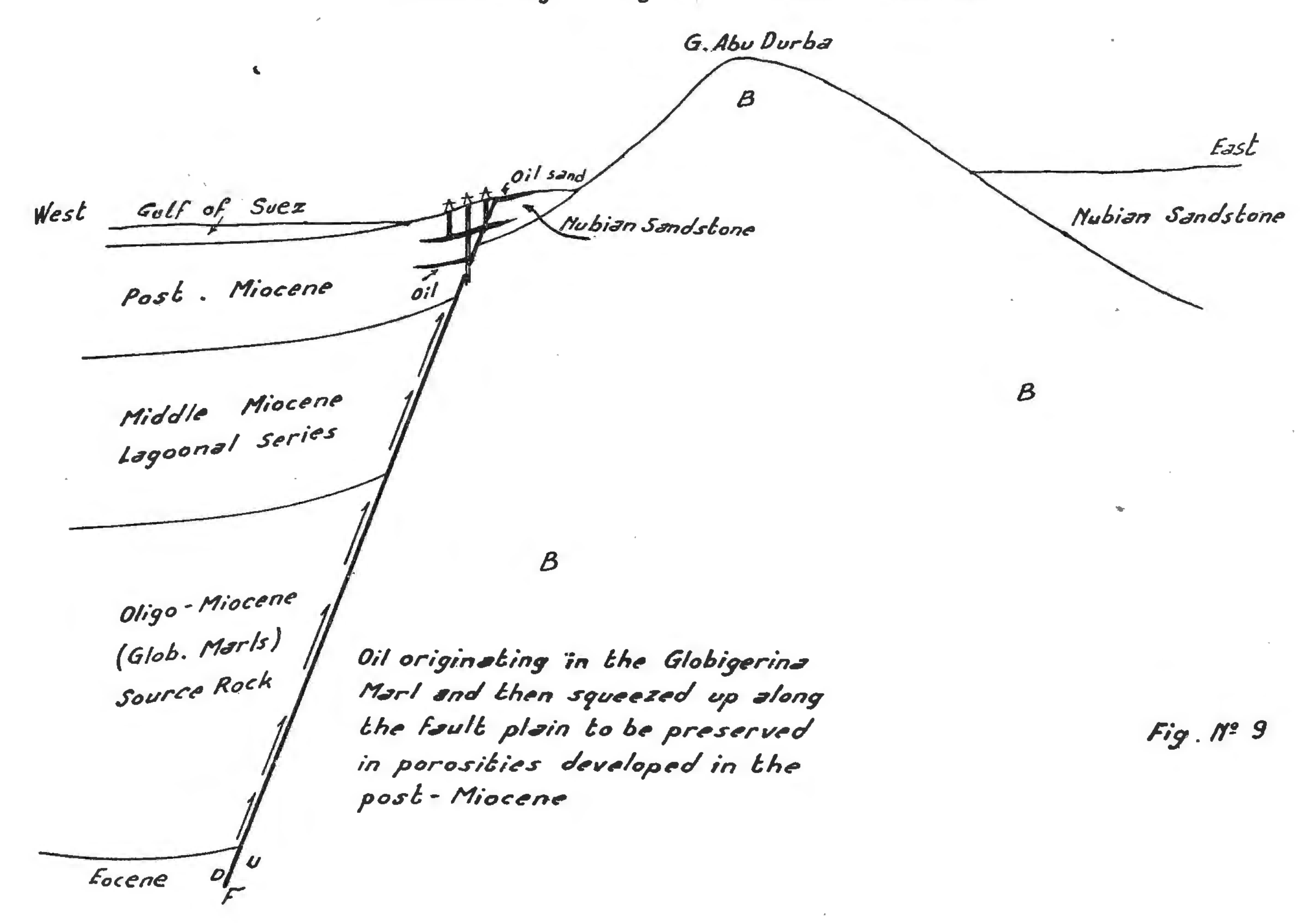
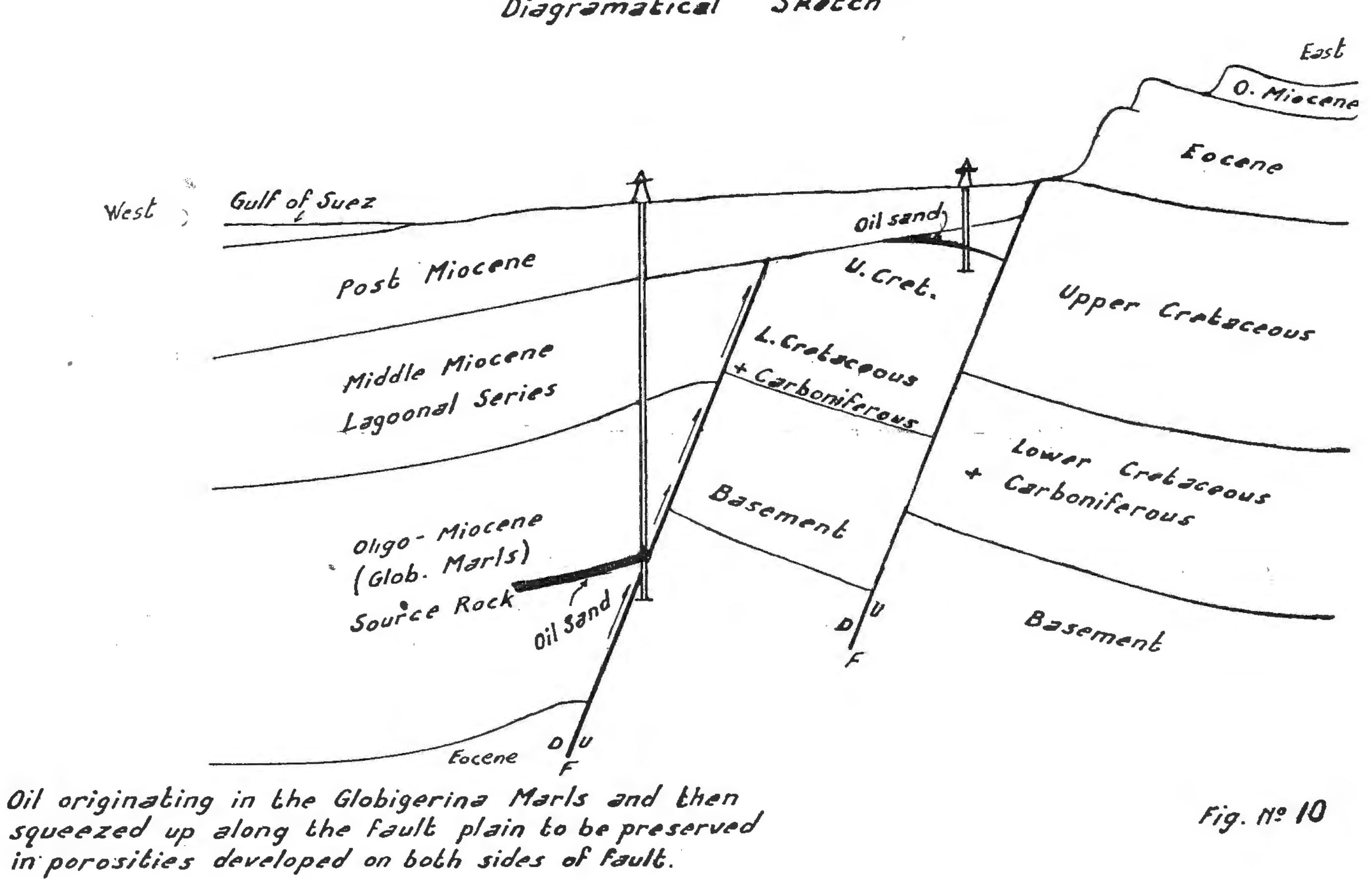


Fig.No. 8
DIAGRAMMATICAL SKETCH
Of
Sudr Oil Field

DIAGRAMATICAL SKETCH
Illustrating Origin of Abu Durba Oil



FEIRAN FIELD
Diagramatical Sketch



DIAGRAMATICAL SKETCH

Illustrating Origin of Tanka Oil

West

Gulf of Suez

G. Tanka

East

Post Miocene

Oil

Upper Eocene

Middle Miocene

Lagoonal Series

M. and L. Eocene

Paleocene

Oil

Oligo - Miocene

(Glob. Marls)

Source Rock

Upper. Cretaceous

Lower Cretaceous

Oil originating in the Globigerina Marls and then squeezed up along the fault plain to be preserved essentially in porosities developed on the upthrown side

Eocene

D U F

Fig. No 11

THOUSANDS OF BARRELS

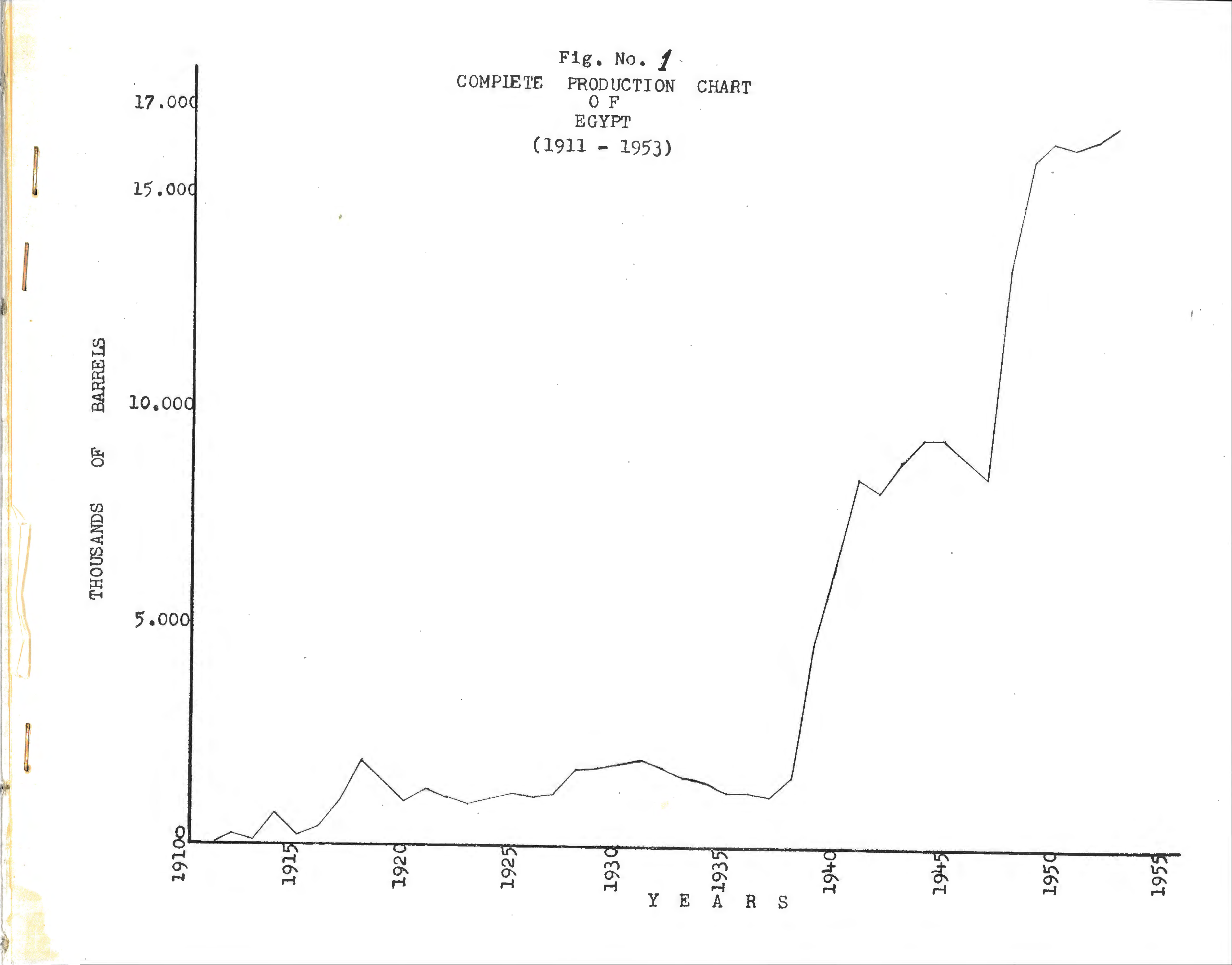
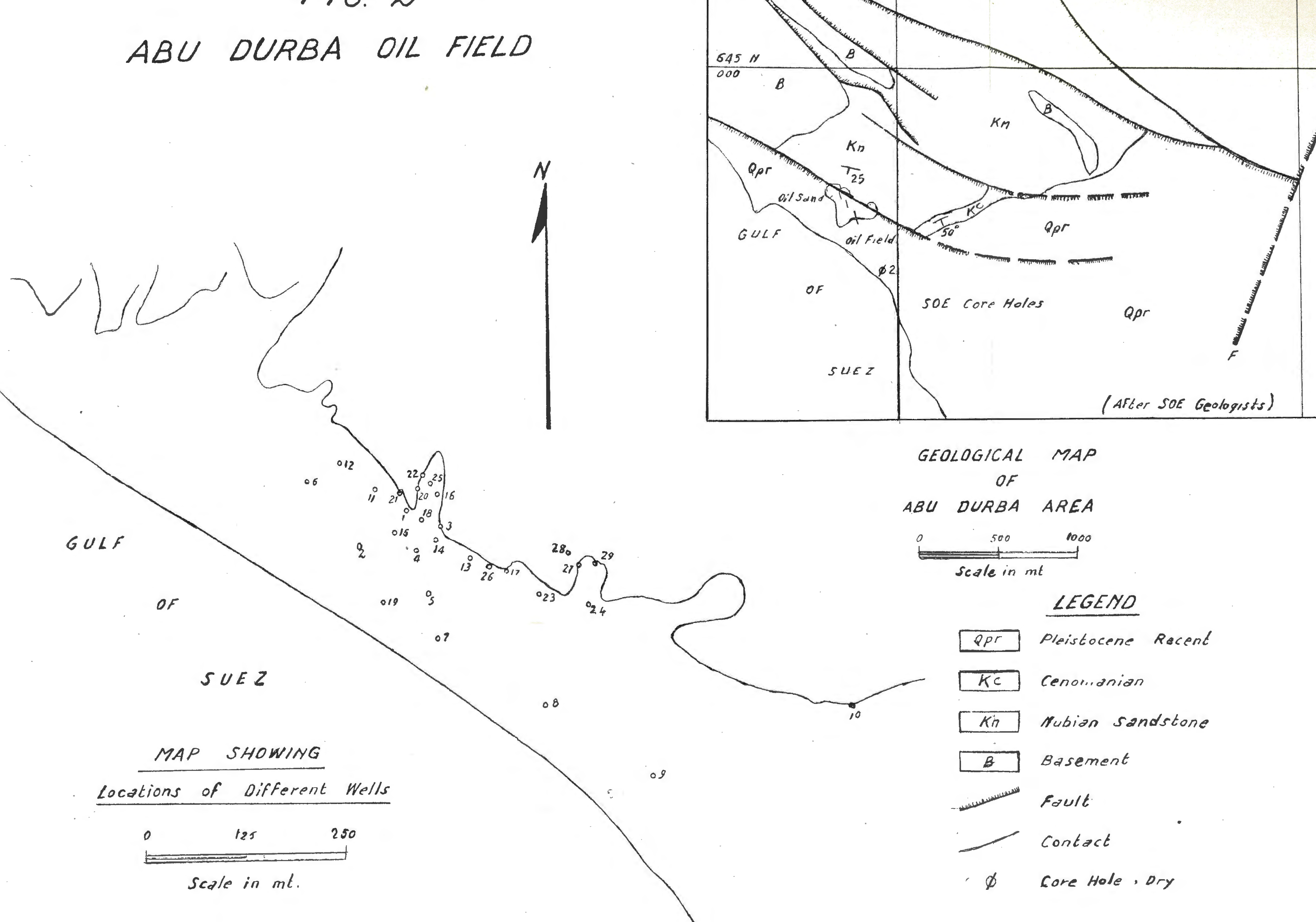

Fig. No. 1
COMPIETE PRODUCTION CHART
O F
EGYPT
(1911 - 1953)
17.000
15.000
10.000
5.000
0
THOUSANDS OF BARRELS
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
Y E A R S

FIG. 2

ABU DURBA OIL FIELD




PLATE 12
MAP SHOWING
SUBDIVISION OF THE PROSPECTIVE AREA OF WEST SINAI
WITH
WILDCAT WELLS AND CORE HOLES
0 5 10 20
Scale in Km.
LEGEND
APPROXIMATE EASTERN LIMIT OF AREA
10 FATHOMS LINE
DIVISION LINE
OIL FIELDS
DRY HOLES
TD. TOTAL DEPTH IN FEET
CH. CORE HOLE
BASEMENT COMPLEX
OIL WELL
N
MEDITERRANEAN SEA
RED SEA
31° 00'
32° 30'
30° 30'
32° 00'
30° 00'
29° 30'
29° 00'
28° 30'
28° 00'
33° 00'
27° 30'
33° 30'
34° 00'
27° 30'
34° 30'
AEO Abu Sultan Well No2 T.D. 2485'
AEO Habashi Well No1 T.D. 2160'
AEO. Ataqa Well No1 T.D. 3938'
AEO-SVO Ayoun Moussa Wells 1) 5451' T.D. 2) 5808'
El Hamra Well No1 TD. 4730'
AEO - SVO Ras Mesalla Wells T.D. 1) 1921' 2) 1147' 3) 2274'
ABU QITIFA Well No1 DT. 2144'
AEO - SVO Sudr Oil Field
AEO - SVO Matarma Well No1 T.D. 6093'
AEO - SVO Matarma Oil Field
AEO - SVO Asl Oil Field
AEO - SVO Nebwi Well No1 T.D. 8394
AEO - SVO Lagia Wells 1) 3995' T.D. 2) 8382'
EP & FC Gharandel Wells TD. No1) 432' No2) 1275'
Tanka Wells S.P No1 T.D. 2930' C.S. No2 T.D. 2292'
B.S.P.C. Matulla Wells 1) 500' T.D. 2) 202' 3) 2110'
S.O.E. Baba CH. No 6, 7 T.D. 2020' 2037'
S.O.E. Baba Well No1
SOE. Rudeis Well No1 TD. 4908'
Nezazat Well SOE 2 TD. 1906'
Egyp. Gov. 1 TD. 212'
Feiran Field
SOE - Feiran CH 1) 1912' 2) 1915' 3) 1817' 4) 1233' 5) 747' 6) 1730' 7) 1998'
SOE. El Balayin CH. No1 TD. 1216'
Abu Durba Oil Field
SOE. Durba CH. TD. No1 1994' 2, 1064'
Ras Gharib Oil Field
Ras Gemsa Oil Field
Hurghada Oil Field
AEO. Ras Mohammad Well No1 TD. 1328
A1
B1
C1
A2
B2
C2
A3
B3
D1
D2

Note on the Distribution of the Triassic Formations in Egypt

by

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In Egypt, Triassic exposures are only known from Araif El Naga (site I, Fig. 1) in East Sinai (Awad, 1945 & Eicher, 1946). The section (approximately 200 mt. thick) is mainly shallow marine and yields a good collection of mega fossils the age of which has been designated as Middle Triassic (Muschelkalk). The basal beds of this section are faulted up against the Upper Cretaceous Chalk. On top, the Triassic section is overlain, apparently conformably, by a 300 mt. section, tentatively assigned to the Lower Cretaceous and is composed of unfossiliferous Nubian type sandstone.

Outside Egypt, lagoonal Triassic strata with a thickness of about 500 mt, is exposed at Wadi Ruman (site II, Fig. 1) 50 km. to the east of Ariaf El Naga (Lat. 30° 35' N, Long. 34° 52' E.). At this locality the succession, as measured in 1946 by geologists from the Standard Oil Company of Egypt and the Iraq Petroleum Company, runs as follows :—

4) Upper Cretaceous flinty chalk, limestone and marl	475 mt
3) Lower Cretaceous Nubian type Sandstone... ...	620 „
2) Jurassic limestone and shale	97.5 „
1) Triassic gypsum, limestone and shale...	465 „

At Wadi Ruman the basal beds are also faulted up against the Upper Cretaceous.

In the subsurface, Triassic rocks have been reported from four deep bores which were drilled for oil in Sinai and in the Eastern

Desert, namely Ayoun Musa Wells No. 1 and 2 (site III), El Hamra Well No. 1 (site IV) and Ataqa Well No. 1 (site V).

Ayoun Musa well No. 1 is located approximately 14 km to the southeast of Suez (Lat. 29° 53′ 08″.5 N, Long. 32° 38′ 58″.2 E). This well was drilled by the AEO[1] and the SVO[2] early in 1945. In this well the succession from the depth of 3106 ft. to 3420 ft. (314 ft. or 96 mt.) was assigned to the Triassic. On top, the Triassic section is overlain by a 780 mt. section of Jurassic and at base, it is underlain directly by the Carboniferous.

Ayoun Musa Well No. 2 is located 2 km. to the east of Well No.1(Lat. 29° 53′ 08″.2 N, Long. 32° 40′ 20″.14 E) and was also drilled by the AEO and the SVO in 1945. This well drilled 215 ft (66 mt) of Triassic section (between 3615 ft and 3830 ft) before it has passed into a formation referred to by their geologists as the Permo-Carboniferous. On top, the Triassic section is overlain by a 890 mt of Jurassic formation.

In both wells theTriassic section is composed of reddish slightly gypsiferous shale and marl (Tromp, 1951).

The third locality where Triassic rocks are known in the subsurface is El Hamra in West Sinai. This site is situated approximately 34 km east of Suez (Lat. 29° 58′ N, Long. 32° 54′ E). El Hamra Well No. 1, was spudded in 1946 and the operations were undertaken by the AEO and the SVO. This well drilled 235 ft (72 mt) of Triassic section (between 3745 ft and 3980 ft), before it came into the Carboniferous. On top, the Triassic section is overlain by a 707 mt of Jurassic section.

Ataqa Well No. 1, the fourth locality where Triassic rocks are present in the subsurface is situated in the northern portion of the Eastern Desert approximately 14 km to the west of Suez. Drilling commenced early in 1947 and the operations were made by the AEO. In this well the succession from 2466 ft to 2715 ft (249 ft or 76 mt)

(1) Anglo - Egyptian Oilfields Ltd.

(2) Socony Vacum Company.

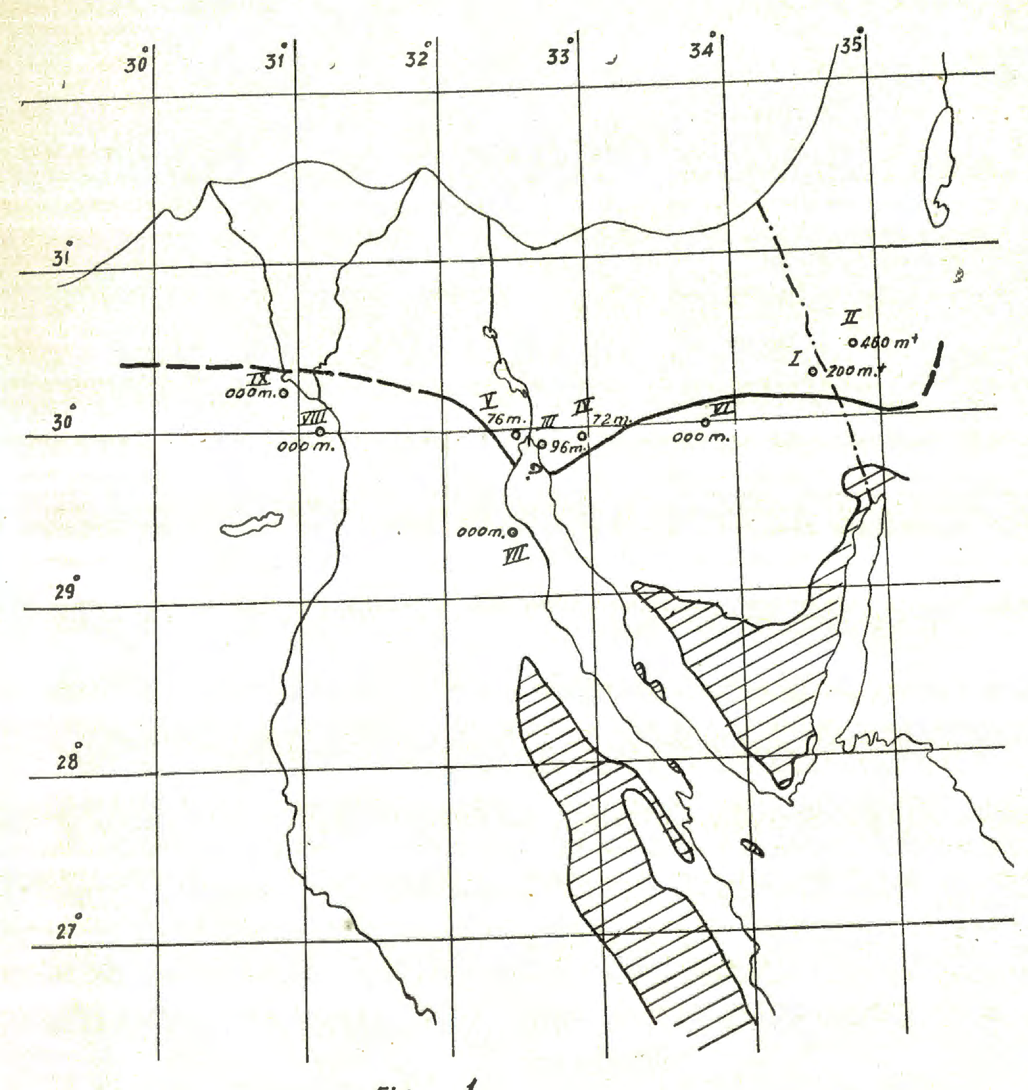


Fig: 1
Showing approximate
Triassic shoreline

was assigned to the Triassic. This section is included between the Jurassic on top and the Permo - Carboniferous below.

Triassic rocks are expected in several other localities* and further deep drilling in Sinai and in the Western Desert will undoubtedly throw much light on the distribution of this formation in Egypt.

From as much information as now available regarding the reported surface and subsurface thicknesses of the Triassic rocks, the construction of an isopach map for this formation is not possible. Only the approximate position of the Triassic shoreline (Fig. 1) could be presented. This line passes to the north of Abu Hamth Well No. 1 (site VI) in North Central Sinai, to the north of Wadi Araba (site VII) in the Eastern Desert and also to the north of Abu Roash Wells (site VIII) and El Khatatba Well (site X) in the Western Desert. In these sites the deep boring showed no traces of the Triassic succession which is known in the other localities.

From the figure illustrated, it is seen that the Triassic sea covered the entire portion of the Sinai peninsula to the north of Latitude 30° and presumably also the main part of the Eastern Desert north of that same latitude. That sea had two short gulfs, one coinciding with the northern end of the Gulf of Suez and the other existed between the Gulf of Aqaba and the Dead Sea. Facts from the Sinai region seem to indicate that the thicknesses of the Triassic sediments increase in a northward direction but the rate is wanting. Along the Mediterranean Coastal Belt these sediments attain presumably maximum development.

This conclusion may lead us to say that Ball's conception (1939, pp 20) according to which "the gradual elevation of the land which began at the end of the Carboniferous period continued in the Permian and that during this period and the Triassic period which followed it practically the whole of Egypt remained dry land", has to be modified.

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* At the time when this paper was submitted for publication, it came to my knowledge that in the wadi El Natrun, Well No. 1 drilled to the west of the Nile Delta, the succession from 12540 ft. to 13300 ft. was assigned to the Triassic.

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The systematics of the Foraminfera of the Mediterranean Sea was the subject of numerous studies. Indeed this Sea provided the types of many species for the old masters. Previous literature dealing with the taxonomy of the Foraminifera of the Mediterranean includes the works of Amicis, Batch, Soldani, Costa, d'Orbigny, Sidebottom, Heron-Allen and Earland, Lacroix and Colom.

The origin of the fauna :—The Mediterranean foraminiferal fauna has much in common with that of the Atlantic coast of southern Europe and North Africa and the usual putting of these areas together as Lusitanian seems justified. The Mediterranean may be looked upon as composed of the following distinct elements :

1.—Autochtonous forms : These include those species and varieties that have descended from the "Neogene Mediterranean Sea". These are supposed to have originated and evolved in this Sea. Among these forms, that make up the majority of the fauna, are the following : *Textularia gramen*, *T. agglutinans*, *Quinqueloculina carinata*, *Q. costata*, *Q. depressa*, *Q. disparilis*, *Q. dutempli*, *Q. laeviagta*, *Q. limbata*, *Q. longirostra*, *Q. pulchella*, *Q. quadrilaterlis*, *Q. striata*, *Q. variolata*, *Q. vulgaris*, *Spiroloculina canaliculata*, *S. colomi*, *S. excavata*, *Triloculina affinis*, *T. dilatata*, *T. gibba*, *T. suborbicularis*, *T. trigonula*, *Globulina gibba*, *Glandulina laevigata*, *Nonion boueanum*, *Elphidium crispum*, *E. excavatum*, *E. macellum*, *Rosalina sidebottomi*, *R. trubo*, *Eponides repandus concameratus*, *Hoglundina elegans*, *Cibicidella variabilis*, and *Planorbulina mediterraensis*.

2.—Cryptogenetic forms: These include the species that have been repeatedly described from pratically all provinces. These are believed to have quickly established themselves all over the world and the Mediterranean is not necessarily the place of their origin. Among these the following may be mentioned : *Quinqueloculina akneriana*, *Q. bicornis*, *Q. ferussacii*, *Q. lamarckiana*, *Q. seminula*, *Articulina sagra*, *Triloculina reticulata*, *T. circularis*, *Elphidium advenum*, *Peneroplis planatus*, *Amphisorus duplex*, *Eponides repandus*, *Mississppina concentrica*, *Cibicides lobatulus*, *and C. refulgens*.

3.—Indo-Pacific forms : These include a small number of species which probably reached the Sea during periods of very temporary connections of that ocean with the Mediterranean. It is in teresting

to note that none of the Indo-Pacific forms that invaded the Eocene "Mediterranean" have survived to the present day. The connection must have taken place at certain stages of the Pleistocene when eustatic changes in sea levels permitted the temporary flooding of the clysmic area (Said, 1955). The recent artificial Suez canal connection could not have been the route through which these species reached the Mediterranean since this canal has produced a hydrographic setup that does not permit the mingling of the Red Sea faunas with those of the Mediterranean (Said, 1950). Among these forms are the following : *Quinqueloculina parkeri, Bolivina tortuosa, Loxostomum limbatum, and Siphonina tubulosa.*

4.—Peruvian forms : these include those species that probably reached the Mediterranean in a series of successive waves from the Eastern Pacific. There is only one species, known in the Mediterranean, *Vulvulineria araucana* that is typical of the Peruvian waters. It is interesting to note that some Molluscan species of similar origin also appear in the Mediterranean. The migration of these species seemed to have taken place during the Miocene when such inter oceanic waves were possible. The intermediary points along which such migrations took place are yet to be discovered.

SYSTEMATIC DESCRIPTIONS

Family TEXTULARIIDAE

Genus TEXTULARIA Defrance, 1824.

Textularia agglutinans d'Orbigny
(Pl. 1, fig. 1)

Textularia agglutinans d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminifères", 1840, p. 136, pl. 1 figs. 17, 18, 32-34.

A few specimens of this species are recorded from sample No. 22. Its slender more or less depressed test and the increasingly higher chambers in the later part of the test distinguish this species which is typically an Atlantic Mediterranean form although records of it in the Red Sea and other seas are known.

Recent Littoral Foraminifera from the Egyptian Mediterranean Coast between Rosetta and Saloum (*)

BY

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This paper describes and illustrates the Recent Foraminifera of that part of the Mediterranean coast that extends from Rosetta westwards to Saloum, a stretch of coast some 650 kms. long. The material that made the basis of this study was collected by N. M. Shukri, G. Phillip and the senior author from some 74 localities. Fig. 1 shows the areal distribution of these localities. This figure was prepared by Mr. Phillip and is here reproduced with his kind permission. The samples were subjected to mechanical and mineral analyses the results of which together with notes on the geomorphology of this stretch of coast are now in press (Shukri, Phillip and Said). All samples here analysed come from the zone lying between the low and high water lines of the fore-shore.

The major part of this stretch of coast is covered with a mantle of sands composed of Ca CO3. The sands have a small total skeletal content varying between nil and 18%. The lower values were recorded from oolitic sands of the open stretches of beach and the higher values were recorded from sheltered bays east of Alexandria.

The Foraminifera recorded are mainly shallow water species, but it must be noted that the forms that are present in any one sample are entirely different in habitat (e.g. representatives of the Family

(*) Communication présentée en séance du 25 Avril 1955.

Textulariidae with those of the Family Miliolidae). Thus the forms that occur in any one sample are controlled by mechanical grading rather than by the local indigenous assemblage. The foraminiferal skeletons are believed to have been distributed and sorted out in accordance with the usual hydrodynamic principles that govern ordinary detrital grains. Worn-out tests are more common along unprotected stretches of the coast where maximum wearing takes place. The study of the distribution of Foraminifera in other similar localities (e.g. Bahama Banks as described by Illing (1950 and 1952)) shows a similar pattern.

In the coarse sand grades, representatives of the families Peneroplidae and Miliolidae occur. Common forms are *Peneroplis planatus*, *P. pertusus*, *Amphistegina radiata*, *Amphisorus duplex*, *Praesorites marginalis* and large specimens of *Quinqueloculina seminula*.

Smaller Peneroplidae are outnumbered by Miliolidae and sometimes Rotaliidae in the medium and fine granied grades. Apart from the numerous Miliolidae, species of the following are common: *Rosalina*, *Eponides*, *Bolivina*, *Siphonina* etc.

The only observation that may have some ecological significance with regard to the appearance of species in the area is the appearance of *Streblus beccarii*, a tpyical brackish water form, in samples east of Alexandria where the effect of the Nile water flowing into the Sea is felt. This stretch of the beach is the oly part of the entire length studied where the silt carrying Nile water affects the beach of the area. There is only one sample from the extreme western part of the coastal strip studied where this species is recorded; and it may be of interest to note that this part receives a larger volume of torrential water thus rendering the water of this coast more fresh. It may also be observed that this larger volume of torrential water affects also the mineralogy of the sands.

The foraminieral fauna recorded from the Rosetta-Saloum area is composed largely of representatives of the Family Miliolidae which make more than 50% of the number of both species and individuals. Most varied are the species of the genera *Quinqueloculina*, *Triloculina* and *Spiroloculina*. Representatives of the Family Peneroplidae are numerous with regard to the number of individuals.

Quinqueloculina bicornis (Walker and Jacob)
(Pl. 1, fig.s. 8, 9)

Serpula bicornis Walker and Jacob, in Kanmacher's ed., Adam's Essays Micr., 1798, p. 633, pl. 14, fig. 2.

Miliolina bicornis H.B Brady, Rep. Voy. *Challenger*, Zoology, Vol 9 1884. pl 6, figs 9-11.

Quinqueloculina bicornis Colom, Inst. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, p. 17, pl. 3, figs. 57-61, 63-66.

This is one of the most widely distributed species in the area (samples Nos. 22, 25, 33 and 63). The coarsely costate periphery differentiates this species which shows great variations. It probably ranges into *Q. duthiersi* (Schlumberger). The two figured specimens show the most common variations in this cosmopolitan species. The oblique costae and rounded edge distinguish this species from *Q. undulata* and *Q. limbata*. This species seems also to merge imperceptibly into *Q. subpoeyana* Cushman.

Quinqueloculina bicarinata d'Orbigny
(pl. 1, fig. 10)

Quinqueloculina bicarinata d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 302, No. 35. — Terquem, Mém. Soc. géol. France, ser. 3, vol. 1, 1878, pl. 7 (12), figs. 10a-c. — Cushman, Bull. 100, U.S. Nat. Mus., 1921, p. 428, pl. 86, figs. 2, 3, pl. 100, fig. 7.

Specimens of this species are distributed throughout the Mediterranean coast (samples Nos. 22, 25, 30 and 33). Our specimens are identical with *Q. bicarinata* d'Orbigny as figured by Terquem. This is a distinct species characterized by two rounded carinae at the outer boarder of the chambers.

Quinqueloculina bradyana Cushman
(Pl. 1, fig. 11)

Miliolina undosa H.B. Brady Rep. Voy. *Challenger*, Zoology, vol. 9 1884, p. 176, pl. 6, figs. 6-8.

Quinqueloculina bradyana Cushman, Bull. 71, U.S. Nat. Mus., pt. 6, 1917, p. 52, pl. 18, fig.2 — Colom, Instit. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, pl. 13, pl. 1, figs. 20, 26, 27. — Said, Special Publ. 26, Cushman Lab. Foram. Res., 1949, p. 9, pl. 1, fig. 22.

This is a frequent species that is recorded in samples Nos. 20, 25 and 33.

Quinqueloculina candeiana d'Orbigny
(Pl. 1, fig. 12)

Quinqueloculina candeiana d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat., Cuba, "Foraminifères", 1840, p. 170, pl. 12, figs. 24, 26. — Cushman, Bull. 104, U.S. Nat. Mus., pt. 6, 1929, p. 27, pl. 3, fig. 1.

This species occurs at a few localities in large numbers (samples Nos. 9 and 33). The Mediterranean specimens are exactly similar to those recorded by Cushman from the Atlantic. Colom's figures (Inst. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, pl. 2, figs. 35, 36) are a little different. This species is characterized by the elongate test, the protruberent neck, the angled chambers and the sharply marked sutures.

Quinqueloculina carinata d'Orbigny
(Pl. 1, fig. 13)

Quinqueloculina carinata Fornasini, Mem. Accad. Sci. Istit. Bologna, ser. 6, vol. 2, 1904, pl. 4, fig. 2.

This species occurs in small numbers at only one locality (sample No. 25). It has been seldom recorded by authors other than d'Orbigny. It is characterized by a test that is twice as long as broad having a smooth surface, an angled or very slightly rounded edge and a terminal toothed aperture without a neck.

Quinqueloculina costata d'Orbigny
(Pl. 1, fig. 14)

Quinqueloculina costata d'Orbigny, Ann. Sci. Nat., Vol. 7, p. 301, No. 3, 1826.

A few specimens of this species are found in sample No. 9. Our specimens are typical and resemble closely d'Orbingy's type which came from the Mediterranean. The numerous fine longitudinal costae that are often slightly oblique to the axis of the chambers distinguish this species.

Textularia candeiana d'Orbigny
(Pl. 1, fig. 2)

Textularia candeiana d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminifères", 1840, p. 135, pl. 1, figs. 25-27. — Lacroix, Bull. Inst. Oceanogr. No. 581, 1932, p. 17, figs. 15-17. — Colom, Instit. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, p. 10, pl. 1, figs. 5 and 6.

A very few typical specimens of this species are recorded in sample No. 22. The elongate test which is tapering and depressed in its early portion and flaring and carinate in its late portion characterize this species.

The rarity of this species together with the other common Mediterranean Textulariidae in our material is due to the fact that these arenaceous forms live in the deeper parts of the Sea.

Textularia gramen d'Orbigny
(Pl. 1, fig. 3)

Textularia gramen d'Orbigny, Foram. Foss. Bass. Tert. Vienne, 1846, p. 248, pl. 15, figs. 4-6.

This species occurs in very few numbers in sample No. 25. It is distinguished from *T. agglutinans* with which it is often confused, in having broader chambers in proportion to height and in having a more reduced test. This species seems to be a survival of the Neogene "Mediterranean Sea".

Textularia sagittula Defrance
(Pl. 1, fig. 4)

Textularia sagittula Defrance, Dict. Sci. Nat., vol. 32, 1824, p. 177, vol. 53, p. 344, Atlas Conc., pl. 13, fig. 5.

A few specimens of this species are found in sample No. 22. Our specimens are very near those described by Colom from the Western Mediterranean.

Family VALVULINIDAE
Genus CLAVULINA d'Orbigny, 1826.
Clavulina difformis H.B. Brady
(Pl. 1, fig. 5)

Clavulina angularis var. *difformis* H.B. Brady, Rep. Voy. *Challenger*, Zoology, 1884, vol. 9, p. 396, pl. 48, figs. 25-31.

A few specimens of this species are found in samples Nos. 22, 33 and 35. Our specimens are similar to, though not identical with those recorded from the Indo-Pacific region in having the last chamber somewhat inflated and the wall more smoothly finished.

Family MILIOLIDAE
Genus QUINQUELOCULINA d'Orbigny, 1826
Quinqueloculina agglutinans d'Orbigny
(Pl. 1, fig. 6)

Quinqueloculina agglutinans d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminifères", 1839, p. 168, pl. 12, figs. 11-13. Said, Special Publ. 26, Cushman Lab. Foram. Res., 1949, p. 8, pl. 1, fig. 17.

This cosmopolitan species occurs in large numbers at many localities (samples Nos. 22, 33, 35, 58 and 63). This species has an arenaceous exterior and a squarish edge that differentiates it from *Q. sclerotica.*

Quinqueloculina akneriana d'Orbigny
(Pl. 1, fig. 7)

Quinqueloculina akneriana d'Orbigny, Foram. Foss. Bass. Tert. Vienne, 1846, p. 290, pl. 18, figs. 16-21. — Said, Special Publ. 26, Cushman Lab. Foram. Res., 1949, p. 9, pl. 1. fig. 18.

Miliolina seminulum H.B. Brady (non Linne), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, pl. 5, fig. 6.

This cosmopolitan species occurs in small numbers at several localities (samples Nos. 8, 20 and 30). Its smoothly finished surface slender test, uniform chambers, rounded edge and elongate wide aperture distinguish it from other species. This species has been put by many authors as a synonym of *Q. seminula* (Linne) but in our material it is well defined.

This species occurs in small numbers at localities Nos. 9 and 17. It is a survival of the Pliocene Mediterranean fauna in the Recent waters of this Sea. It is a distinct species characterized by a flattened and smooth test, an angular edge, a rather slender neck and a toothed aperture. The chambers become bigger as they are added. The authors are inclined to separate this species from *Q. laevigata*, a name which here designates a related species with an elongate test and a more rounded edge. In such a case Sidebottom's *Q. laevigata* (Mem. Proc. Manchester Lit. Phil. Soc., vol. 48, 1904, pl. 4, figs. 1-3) should be put in synonymy with *Q. longirostra.*

Quinqueloculina parkeri (H.B. Brady)
(Pl. 1, fig. 23)

Miliolina parkeri H.B. Brady, Quart, Journ. Micr. Soc., vol. 21, 1881, p. 46. — Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 177, pl. 7, fig. 14.

This species occurs in very small numbers at only one locality (sample No. 25). It is slightly smaller than usual. This is the first record of this species outside the Indo-Pacific region.

Quinqueloculina polygona d'Orbigny
(Pl. 1, fig. 24)

Quinqueloculina polygona d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1839, "Foraminifères", p. 198, pl. 12, figs. 21-23.

This species occurs in small numbers at only a few localities (samples Nos. 9, 22 and 63). It is a distinct species that is different from *Q. ferussacii* (of Heron-Allen and Earland) by having a thicker test with concave lateral faces at the keeled periphery. Our specimens are identical with those recorded by Cushman from the Atlantic.

Quinqueloculina pulchella d'Orbigny
(Pl. 1, fig. 25)

Quinqueloculina pulchella d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 303, No. 42. — Colom, Inst. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, p. 17, pl. 3, figs. 51-58, 62.

Specimens referred to this species resemble those cited in the synonymy. The species is characterized by an irregular concave and very coarse costae and thereby differing slightly from Fornasini's tracing of the original d'Orbigny figure (Mem. Accad. Sci. Istit. Bologna, ser. 5, vol. 10, 1902, p. 24; ser. 6, vol. 2, 1905, p. 69, pl. 4, fig. 11).

Quinqueloculina quadrilateralis d'Orbigny
(Pl. 1, fig. 26)

Quinqueloculina quadrilateralis Martinotti, Atti. Soc. Ital. Soc. Nat., vol. 59, 1920, fig. 102 (in text); pl. 12, figs. 12-14. — Colom, Inst. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, p. 12, pl. 1, figs. 17-22.

Miliolina contorta Sidebottom, Mem. Proc. Manchester Lit. Phil. Soc., vol. 48, 1904, pl. 4, figs. 7-9.

This species occurs in large numbers at sample No. 25. It is identical with *Miliolina contorta* as figured by Sidebottom from the Island of Delos, Grecian Archipelago. This species is distinghuied by truncate sides and contorted periphery.

Qunqueloculina sclerotica Karrer
(Pl. 1, fig. 27)

Quinqueloculina sclerotica Karrer, Sitz. Akad. Wiss. Wien., vol. 43, 1868, Abt. 1, p. 152, pl. 3, fig. 5. — Cushman, Bull. 104, U.S. Nat. Mus., pt. 6, 1929, p. 24, pl. 1, fig. 5a-c.

This species occurs in small numbers at samples Nos. 26 and 33. Our specimens are very much similar to those recorded by Cushman from the Atlantic. They differ, however, from those recorded from the Red Sea (Said, Special Publ. 26, Cushman Lab. Foram. Res., 1949, p. 11, pl. 1, fig. 30) in having more defined edges.

Quinqueloculina seminula (Linné)
(Pl. 1, fig. 28)

Serpula seminulum Linné, Syst. Nat., ed. 12, 1767, p. 1264, No. 791.

Miliolina seminulum H.B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 157, pl. 5, figs. 6a-c.

This species occurs in small numbers at localities 22 and 58 where they occur in specimens as long as 3mm in length.

Quinqueloculina striata d'Orbigny
(Pl. 1, fig. 30)

Quinqueloculina striata d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 301, No. 4. — Fornasini, Mem. Accad. Sci. Istit. Bologna, ser. 6, vol. 2, 1904, pl. 2, fig. 7.

This species occurs in small numbers at several localities (samples Nos. 8, 22, 25 and 33). This species is characterized by an ornamented surface with fine longitudinal striae. It is differentiated from *Q. costata* in having a slender neck, flatter and borader test and a rounded toothless aperture.

Quinqueloculina depressa d'Orbigny
(Pl. 1, fig. 15)

Quinqueloculina depressa d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 302, No. 38. — Cushman, Special Publ. 13, Cushman Lab. Foram. Res., 1945, p. 16, pl. 2, figs. 10-14; pl. 4, fig. 3.

This species occurs in small numbers at only one locality (sample No. 74). This species came originally from the Pliocene of Castel Arquato and was later recorded from the Lower Pleistocene of the Isle of Rhodes by Terquem. This is a survival of the Neogene Mediterranean fauna in the Recent.

Quinqueloculina disparilis d'Orbigny
(Pl. 1, fig. 16)

Quinqueloculina disparilis d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 302, No. 21. — Fornasini, Mem. Accad. Sci. Istit. Bologna, ser. 6, vol. 2, 1904, pl. 3, fig. 10.

This species recorded in large numbers by Colom in Bahia, occurs only in sample No. 8 in small numbers. As it appears in Fornasini's tracings and later figures this species is easily distinguished by its rounded and costate peripheral face. This species has also been recorded from the Atlantic and the Indo-Pacific regions but not from the Red Sea.

Quinqueloculina dutemplei d'Orbigny
(Pl. 1, fig. 17)

Quinqueloculina dutemplei d'Orbigny, Foram. Foss. Bass. Vienne, 1846, p. 294, pl. 19, figs. 10-12. — Cushman, Special Publ. 13, Cushman Lab. Foram. Res., 1945, p. 8, pl. 1, figs. 9-15.

This species is common in the Mediterranean Miocene and Pliocene dèposits. It occurs in small numbers in our Recent material (samples Nos. 8 and 74).

Our specimens are identical with the Pliocene Castel Arquato material as separated and recorded by Cushman. Cushman's Recent record of the species in the North Pacific region is not exactly identical.

Quinqueloculina ferussacii d'Orbigny
(Pl. 1, fig. 18)

Quinqueloculina ferussacii d'Orbigny, Ann. Sci. Nat. vol. 7, 1826, p. 301, No. 18.

This distinct species characterized by its thin test, slender neck and acute, somehwat folded carinae is a rare species that is represented in our material only by a few specimens at locality 22.

Quinqueloculina laevigata d'Orbigny
(Pl. 1, fig. 19)

Quinquelocultna laevigata d'Orbigny, Ann. Sci. Nat., vol. 7, 1826 p. 301, No. 6. — Colom, Instit. Espanol Oceanografia, ser. 2, Notas y Res., No. 108, 1942, p. 15, pl. 2, figs. 37, 40, 41, 44, 45.

This is one of the most widely distributed species in the area (samples Nos. 8, 9, 22, 25 and 30). This species is probably related to *Quinqueloculina longirostra* and although it could be distinguished from it by its slender form it ranges into it imperceptibly.

Early stages in the development of this species are found as separate specimens, thus forming the Genus *Adelosina* d'Orbigny.

Quinqueloculina larmarckiana d'Orbigny
(Pl. 1, fig. 20)

Quinqueloculina lamarckiana d'Orbigny in De la Sagra, Hist. Fis. Pol. Nat. Cuba, 1840, "Foraminifères", p. 189, pl. 11, figs. 14, 15.

This cosmopolitan species is widely distributed in the Mediterranean. It occurs in large numbers in samples Nos. 17, 20, 22, 25 and 33. This species is characetrized by having a smooth and polished test and by having chambers which are triangular in transverse section. It seems that this species is very similar to *Q. auberiana* d'Orbigny.

Quinqueloculina limbata d'Orbigny
(Pl. 1, fig. 21)

Quinqueloculina limbata d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 302, No. 20. — Colom, Instit. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, p. 17, pl. 2, fig. 47.

A few specimens of this species are found in sample No. 30 only. This species is similar to young *Q. bicornis* except for the fact that here the strong costae are parallel to the axis of the chambers. Our specimens are very similar to those recorded by Cushman and Colom.

Quinqueloculina longirostra d'Orbigny
(Pl. 1, fig. 22)

Quinqueloculina longirostra d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 303, No. 46. — Cushman, Special Publ. 13, Cushman Lab. Foram. Res., 1945, p. 16, pl. 1, figs. 1-8.

Quinqueloculina undulata d'Orbigny
(Pl. 1, fig. 31)

Quinqueloculina undulata d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 302, No. 27. — Schlumberger, Mém. Soc. Zool. France, vol. 6, 1893, p. 71, pl. 1, figs. 53, 53, pl. 2, figs. 60, 61. — Colom, Instit. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, p. 16, pl. 3, figs. 49, 50.

Specimens identical with Schlumberger's and Colom's figures as recorded from the Marsella and Bahia gulfs are recorded in our material at a few localities (samples Nos. 30 and 63). Records of this species outside the Mediterranean region seem to be identidal with those of d'Orbigny as traced by Fornasini.

Quinqueloculina variolata d'Orbigny
(Pl. 1, fig. 29)

Quinqueloculina variolata Fornasini, Mem. Accad. Sci. Istit. Bologna, ser. 6, vol. 2, 1904, pl. 4, fig. 1.

This species occurs in small numbers at only one locality (sample No. 58). No record of this species has been noted by authors later than d'Orbingy. This species is characterized by an elongate pitted test with truncate edge and an elongate toothed aperture as wide as the last chamber.

Quinqueloculina vulgaris d'Orbigny
(Pl. 2, fig. 1)

Quinqueloculina vulgaris d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 302, No. 33.

This species occurs sporadically and in small numbers at several localities (samples Nos. 20 and 25).

Genus SPIROLOCULINA d'Orbigny, 1826
Spiroloculina antillarum d'Orbigny
(Pl. 1, fig. 32)

Spiroloculina antillarum Cushman and Todd, Special Publ. 11, Cushman Lab. Foram. Res., 1944, p. 44, pl. 6, figs. 28-32. — Colom, Instit. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, p. 28, pl. 6, figs. 122, 130-132.

Typical specimens of this West Indian species are found in large numbers in our material (samples Nos.9, 17, 20, 22, 30, 33 and 63).

The typically rounded periphery and the slender and costate test distinguish this species. The authors are inclined to agree with Cushman and Todd in suppressing the variety previously described as *S. antillarum angulata* as it differs so little and so gradually from the typical form that a varietal name is not warranted.

Spiroloculina canaliculata d'Orbigny
(Pl. 1, fig. 33)

Spiroloculina canaliculata Cushman and Todd, Special Publ. 11, Cushman Lab. Foram. Res., 1944, p. 22, pl. 4, figs. 1-11.

This species occurs in small numbers at localities Nos. 9, 17, 20, 22, 30, 33 and 63. It is possible that Colom's *S. impressa* (Inst. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, pl. 6, figs. 12-128) belongs here. Our specimens have a slightly concave periphery and the chambers are not as high as typical species. This is a typically late Tertiary and Recent Mediterranean species.

Spiroloculina colomi Said and Kamel, new name
(Pl. 1. fig. 34)

Spiroloculina limbata Fornasini, Mem. Accad. Sci. Istit. Bologna, ser. 6, vol. 1, 1904, p. 6, pl. 1, fig. 11.

Spiroloculina cf. *limbata* Colom, Instit. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, p. 27, pl. 6, figs. 118, 119.

This species was originally described by d'Orbingy as *S. limbata* from the Pliocene of Castel Arquato, Italy after an earlier Soldani figure (Ann. Sci. Nat., vol. 7, 1826, p. 299). The d'Orbingy material was traced later by Fornasini (1904). Fornasini's figure, however, does not resemble an earlier figure published by Parker, Jones and H.B. Brady (Ann. Mag. Nat. Hist., ser. 4, vol. 8, 1871, pl. 8, fig. 22) for *S. limbata* drawn from the original material of Soldani. Parker, Jones and Brady's figure should, therefore, be considered the type figure for *S. limbata* while Fornasini's tracing deserves the new name *S. colomi.*

Test nearly twice as long as broad, chambers increasing rapidly as added, periphery somewhat concave on both sides, aperture with a single tooth and quadrate, wall smoothly finished.

This species occurs in small numbers at several localities (samples Nos. 22, 33 and 35).

Spiroculina excavata d'Orbingy
(Pl. 1, fig. 2)

Spiroculina excavata Cushman and Todd, Special Publ. 11, Cushman Lab. Foram, Res., 1944, p. 23, pl. 4, figs. 12, 13.

This late Tertiary and Recent Mediterranean species occurs in small numbers at localities Nos. 22 and 33.

The depressed central portion, the truncate periphery and the quadrangular aperture distinguish this species.

Genus ARTICULINA d'Orbigny, 1826
Articulina sagra d'Orbingy

Articulina sagra d'Orbingy, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminifères", 1839, p. 160, pl. 9, fig. 23-26. — Sidebottom, Proc. Manchester Lit. Phil. Soc., vol. 48, 1904, No. 5, p. 17, pl. 4, figs. 18-20.

Typical specimens of this species are found only in samples Nos. 33 and 56. The triloculine early portion, which is large and represents almost one third of the whole test, and the everted broad lip characterize this species. This species is widely distributed in modern seas.

Genus TRILOCULINA d'Orbingy, 1826
Triloculina affinis d'Orbingy
(Pl. 1, fig. 35)

Triloculina affinis d'Orbingy, Ann. Sci. Nat., vol. 7, 1826, p. 299, No. 2. — Fornasini, Mem. Accad. Sci. Istit. Bologna, ser. 6, vol. 2, 1905, p. 59, pl. 1, fig. 1. — Colom, Instit. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, p. 21, pl. 4, figs. 79-82.

This species occurs frequently at several localities (samples Nos. 9, 17, 25, 30 and 63). This species can be considered as a survival of the Mediterranean Neogene fauna in the Recent Sea. Our specimens are identical with those recorded by Colom. This species is differentiated from *T. trigonula* by having sharper peripheral angles.

Trioculina dilatata d'Orbingy
(Pl. 2, fig. 3)

Triloculina dilatata d'Orbingy, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminifères", p. 166, pl. 11, figs. 28-30. — Sclumberger, Mém. Soc. Zool. France, vol. 6, 1893, p. 75, pl. 3, figs. 70-74; pl. 4, figs. 87-90.

Triloculina dilatata Colom, Instit. Espanol Oceanografia, Noyas y Res., ser. 2, No. 108, 1942, pl. 5, figs. 93-95, 99.

This species occurs only at one locality (sample No. 33). Our specimens are identical with those recorded by Schlumberger from the Gulf of Massella and those recorded by Colom from the Western Mediterranean.

This species is somewhat irregular in the arrangement of chambers, the last chamber so turned as to put the aperture in a lateral position. The specimens that were dissected were perfectly triloculine in chamber arrangement.

Trioculina gibba d'Orbigny
(Pl. 1, fig. 36)

Triloculina gibba d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 299, No. 3. — Cushman, Special Publ. 13 Cushman Lab. Foram. Res., 1945, p. 26, pl. 3, figs. 10-11; pl. 6, figs. 11.

This species originally described from the Mediterranean by Soldani (Testaceographia, vol. 1, pt. 3, 1795, p. 232, pl. 157, figs. I-K) and by d'Orbingy in Rimini, Adriatic Sea, is found in our collections at localities Nos. 22, 23 and 25. This species has an undulated periphery. It may also be a survival of the Neogene Mediterranean Sea in the Recent.

Triloculina oblogna (Montagu)
(Pl. 1, fig. 37)

Vermiculum oblongum Montagu, Test. Brit., 1803, p. 522, pl. 14, fig. 9.

Triloculina oblonga Cushman, Bull. 104, U.S. Nat. Mus., pt. 6, 1929, p. 57, pl. 13, figs. 4, 5. — Colom, Instit. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, p. 21, pl. 4, figs. 69-71, 75, 78.

This is probably the commonest species of all the representatives of the Family Miliolidae in the area. It occurs in samples Nos. 17, 20, 22, 23, 25, 30, 33 and 63. It has an elongate test and a characteristic elongate aperture as broad as the last chamber.

Triloculina reticulata d'Orbigny
(Pl. 1, fig. 38)

Triloculina reticulata d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 299, No. 9. — Colom, Instit. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, p. 19, pl. 5, figs. 86a, b.

A very few specimens of this species are recorded at only one locality (sample No. 33). Our specimens are very close to those described by Brady from south of New Guinea and West Indies.

Triloculina rotunda d'Orbingy
(Pl. 1, fig. 39)

Triloculina rotunda d'Orbingy, Ann. Sci. Nat., vol. 7, 1826, p. 299. — Schlumberger, Mém. Soc. Zool. France, vol. 6, 1893, p. 64, pl. 1, figs. 48-50. — Colom, Instit. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, p. 22, pl. 4, figs. 84, 85.

This species is common at samples Nos. 20 and 33. It is characterized by a more or less rounded test slightly longer than borad, by indistinet sutures and by an oval aperture as broad as the last chamber.

Triloculina sidebottomi (Martinotti)
(Pl. 1, fig. 40)

Miliolina subrotunda Sidebottom (non Montagu), Mem. Proc. Manchester Lit. Philos. Soc., vol. 48, 1904, No. 5, p. 8, fig. 2 (in text), pl. 3, figs. 1-17.

Sigmoilina sidebottomi Martinotti, Atti. Soc. Ital. Sci. Nat., vol. 59, 1920, p. 2, fig. 29.

Triloculina sidebottomi Colom, Instit. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, p. 24, pl. 5, figs. 106-108.

This species occurs in small numbers at locality No. 25. It is characterized by the rounded lipped and large aperture, by its strongly embracing last chamber and by being broader than long. It is possible that *T. orbicularis* (Cushman, Bull. 71, U.S. Nat. Mus., pt. 6, 1917, pl. 26, fig. 1) should be placed is synonymy of this species.

Triloculina suborbicularis d'Orbingy
(Pl. 1, fig. 41)

Triloculina suborbicularis d'Orbingy, Ann. Sci. Nat., vol. 7, 1826, p. 300, No. 12. — Cushman, Bull. 104, U.S. Nat. Mus., pt. 6, 1929, p. 65, 16, figs. 5a-c; pl. 17, fig. 3. — Colom, Instit. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, p. 23, pl. 5 figs. 96, 101-105.

Miliolina suborbicularis Sidebottom, Mem. Proc. Manchester Lit. Philos. Soc., vol. 49, No. 5, 1904, No. 16, 1910, p. 3.

This typically Mediterranean species occurs in small numbers at locality No. 22. This is a well defined striated species with a rounded test, indistinct sutures and an aperture with a small triangular plate standing in front of it. This plate is so small that this species can still be considered a species of the genus *Triloculina* rather than *Triloculinella*.

Triloculina trigonula (Lamarck)
(Pl. 1, fig. 42)

Miliolina trigonula H.B. Brady, Rep. Voy. *Chanllenger*, Zoology, vol. 9, 1884, p. 164, pl. 3, figs. 14-16.

Triloculina trigonula Colom, Instit. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, p. 22, pl. 4, fig. 76 — Said, Special Publ. 26, Cushman Lab. Foram. Res., 1949, p. 19, pl. 2, fig. 12.

This is one of the common species in the area. It is recorded from samples Nos. 8, 9, 10, 22 and 33. This is a distinct species that has been recorded from many parts of the Recent seas but seems to be especially abundant in the Mediterranean East Atlantic region.

Family OPHTHALMIDIIDAE
Genus VERTEBRALINA d'Orbingy, 1826
Vertebralina striata d'Orbigny
(Pl. 1, fig. 43)

Vertebralina striata d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 283, No. 1, Mod. No. 81. — Cushman, Bull. 104, U.S. Nat. Mus., pt. 6, 1929, p. 96, pl. 22, figs. 6a-b.

This characteristic species is found in small numbers at samples Nos. 9, 17, 22, 33, 38 and 63. It is typically a Mediterranean East Atlantic species which has been recorded in the Indo-Pacific region. The compressed striate test and the flaring uncoiled chambers which are broad and low make this species distinctive.

Family LAGENIDAE
Genus ROBULUS Montfort, 1808
Robulus gibbus (d'Orbigny)
(Pl. 2, fig. 4)

Cristellaria gibba d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminifères", 1839, p. 63, pl. 7, figs. 20-21.

A few typical specimens of this species are found in sample No. 58. It has been recorded from the Western Mediterranean by Colom at a depth of 300 m.

Family POLYMORPHINIDAE
Genus GLOBULINA d'Orbigny, 1839
Globulina gibba d'Orbigny
(Pl. 2, fig. 5)

Globulina gibba d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 226, No. 20. — Cushman, Proc. U.S. Nat. Mus., vol. 77, Art. 6, 1930, p. 60, pl. 16, figs. 1-4.

This species occurs in small numbers at samples Nos. 20, 22, 25, 33, 35 and 63. The globuline test, the few inflated chambers and the slightly produced apex make this species distinctive. It is a typical Mediterranean-East Atlantic species.

Genus GLANDULINA d'Oribigny, 1826
Glandulina laevigata d'Orbigny

Nodosaria (Glandulina) laevigata d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 252, No. 1; pl. 10, figs. 1-3.

Glandulina laevigata Cushman, Proc. U.S. Nat. Mus., vol. 77, Art. 6, 1930, p. 143, pl. 40, fig. 1a, b.

A few specimens of this species are found in samples Nos. 20 and 35. This is a late Tertiary and Recent Mediterranean species.

Family NONOINONIDAE
Genus NONION Montfort, 1808
Nonion boueanum (d'Orbigny)
(Pl. 2, fig. 6)

Nonionina boueana d'Orbigny, Foram. Foss. Vienne, 1846, p. 108' pl. 5, figs. 11, 12.

A few typical specimens of this species have been found at only one locality (sample No. 22). This species together with others represent the last survivals of the late Tertiary Mediterranean fauna in the Recent Sea.

Genus NONIONELLA Cushman, 1929
Nonionella sp.
(Pl. 2, fig. 7)

Test nearly circular in side view, periphery rounded, ventrally unumbilicate and involute, dorsally with the earlier coils visible; chambers distinct, about 8 in the adult whorl; sutures distinct, slightly depressed, slightly curved; wall thin hyaline, smooth; aperture at the base of the apertural face extending over slightly into the ventral side.

This species resembles *N. auricula* Heron-Allen and Earland except for its circular test and less ornamented umbilical part of the ventral side.

A very few specimens of this species are found in sample No. 17.

Genus ELPHIDIUM Montfort, 1808
Elphidium advenum Cushman
(Pl. 2, fig. 8)

Elphidium advenum Cushman, Bull. 104, U.S. Nat. Mus., pt. 7, 1930, p. 25, pl. 10, figs. 1, 2.

This cosmopolitan species is found in small numbers at localities Nos. 9, 17, 22 and 33. This species is characterized by its medium size for the genus, the presence of a very slightly elevated smooth boss and numerous short retral processes.

Elphidium crispum (Linne)
(Pl. 2, fig. 9)

Elphidium crispum Cushman, Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 20, pl. 4, figs. 3, 4.

This Mediterranean species is found in small numbers at various localities (samples Nos. 8, 17, 22, 25 and 63). Our specimens are typical with the rounded periphery and pitted boss. *E. crispum* is recorded from the late Teritary deposits of the Mediterranean region.

Elphidium excavatum (Terquem)
(Pl. 2, fig. 10)

Polystomella excavata Terquem, Essai sur les Anim. plage Dunkerque, pt. 1, 1875, p. 25, pl. 2, figs. 2a-f.

A few typical specimens of this species are found in sample No. 25. This species is distinguished by a test which is medium sized for the genus, by very short retral processes and by the absence of a boss. This is a typical East Atlantic-Mediterranean species.

Elphidium macellum (Fichtel and Moll)
(Pl. 2, fig. 11)

Elphidium macellum Cushman, Contr. Cushman Lab. Foram. Res. vol. 5, 1929, p. 18, pl. 4, figs. 1, 2.

A typical few specimens of this Mediterranean species are found

in samples Nos. 9, 22, 33, 35 and 67. It is a characteristic species having chambers with about 10 to 12 retral processes which give to the keeled test a highly ornamented appearance.

Elphidium maioricense Colom
(Pl. 2, fig. 12)

Elphidium maioricense Colom, Instit. Espanol Oceanografia, Notas y Res., ser. 2, No. 108, 1942, p. 34, pl. 10., figs. 189-193.

A number of specimens that seem to belong to this species occur in our material at samples Nos. 17, 20, 22 and 30.

The test is depressed, the chambers are numerous and with long and numerous retral processes. This is a species that has been hitherto recorded only in the Mediterranean region.

Family PENEROLIDAE
Genus PENEROPLIS Montofrt, 1898
Peneroplis pertusus (Forskal)
(Pl. 1, figs. 44 and 45)

Peneroplis pertusus Hofker, Journ. Roy. Micr. Soc., vol. 71, 1951, p. 305, figs. 23-30 (in text).

This species occurs in large numbers in samples Nos. 22, 25, 30, 33, 58, 63, 67 and 74. The partially involute coiled and biumbilicate test and the chambers which increase in width only slightly as added characaterize this species that seem to be characteristic of of the Mediterranean region.

Peneroplis planatus (Fichtel and Moll)
(Pl. 2, fig. 13)

Peneroplis planatus Höfker, Journ. Roy. Micı. Soc., vol. 71, 1951, p. 342, figs. 19-22 (in text).

Typical specimens of this species are found in sample No. 67. The fanning out distinct and striated chambers together with the cribrate aperture distinguish this species now recorded from many tropical shallow water modern seas.

Genus AMPHISORUS Ehrenberg, 1840
Amphisorus duplex (Carpenter)
(Pl. 1, fig. 46)

Orbitolites duplex Carpenter, Rep. Voy. *Challenger*, Zoology, vol. 7, pt. 21, 1883, p. 25, pl. 3, figs. 8-14.

Typical specimens of this species, recorded from many modern seas, occur in large numbers in the coarse grained samples Nos. 25, 35, 58 and 67. The oval chambers, and the thin test with rounded periphery distinguished this species.

Genus PRAESORITES H. Douville, 1902
Praesorites orlitolitoides (Hofker)

Orbitolites marginalis H.B. Brady, Rep. Voy. *Challenger* Zoology, vol. 9, 1884, p. 214, pl. 15, figs. 1-5.

This species occurs in large numbers at several localities (samples Nos. 17, 20, 22, 25, 35 and 63). It is usually associated with *Peneroplis* and *Amphisorus* species.

Family BULIMINIDAE
Genus BOLIVINA d'Orbigny, 1839
Bolivina tortuosa H.B. Brady
(Pl. 2, fig. 15)

Bolivina tortuosa H.B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 420, pl. 52, figs. 31-34.

Typical specimens of this species occur in small numbers at localities Nos. 25 and 33. The somewhat elongate tapering test with margin bent obliquely towards the median line on either side distinguish this Indo-Pacific species which has been recorded from the Mediterranean by Sidebottom.

Genus LOXOSTOMUM Ehrenberg, 1854
Loxostomum limbatum (H.B. Brady)
(Pl. 2, fig. 18)

Bolivina lobata H.B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 425, pl. 53, figs. 22, 23.

A few typical specimens of this species occur in our material at locality 33. This species develops typically in the Indo-Pacific region and its record in the Mediterranean is unqiue.

Family ROTALIIDAE
Genus ROSALINA d'Orbigny, 1826
Rosalina globularis d'Orbigny
(Pl. 2, fig. 16)

Rosalina globularis d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, pl. 13 figs. 1, 2; Mod. No. 69.

This is a common species that occurs in the fine grained samples Nos. 17, 20, 22, 25, 30, 33, 35 and 63.

The rounded periphery, the increasing size of the chambers as added, the coarsely perforate dorsal side of the test and the longitudinal aperture that lies on the ventral side beneath the somewhat extended portion of the inner end of the last chamber characterize this species. Records of this species from the Recent seas range from the Atlantic to the Pacific.

This species has been assigned to the Genus *Discopulvinulina* Hofker, 1951, but the authors agree with Hornibrook and Vella (1954) on reserving the Genus *Discopulvinulina* to the "*Discorbis bertheloti*" group.

Rosalina sidebottomi Said and Kamel, n. name
(Pl. 2, fig. 19)

Discorbis rosacea Sidebottom, Mem. Proc. Manchester Lit. Phil. Soc., vol. 52, No. 13, 1908, p. 12, pl. 4, figs. 3-5; vol. 54, No. 16 1910, p. 25.

Specimens exactly identical with those recorded by Sidebottom as *Discorbis rosacea* from the Mediterranean region occur in small numbers in samples Nos. 17 and 25.

The original description of *Discorbis rosacea* is d'Orbigny's *Rotalia rosacea* (Ann. Sci. Nat., vol. 7, 1826, p. 273, No. 15, Mod. No. 39) from the Miocene of Bordeaux which was examined by Cushman and identified as an *Amphistegina* "of the less complex type" (Cushman, Bull. 104, U.S. Nat. Mus., pt. 8, 1931, p. 31). Sidebottom's record needs, therefore, a new name to which *Rosalina sidebottomi* is suggested.

Test plano-convex, dorsal side high spired, peripheral margin acute, carinate; chambers numerous, seven or eight in the last whorl; sutures slightly curved, distinct and usually very slightly limbate; wall smooth and clear, umbilical region wide open or thickneed with stellate like thickening; aperture elongate, sutural and large. This species is characterized by its carinate periphery, concave ventral side, small size, high spired test and clear wall. The thickened umbilicus gives an indication of the close relationship of this species to those of the genus *Gavelinopsis* Hofker, 1951.

Rosalina turbo (d'Orbigny)
(Pl. 2, fig. 20)

Rotalia (*Trocholina*) *turbo* d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 247, No. 39, Mod. No. 73.

Discorbina turbo Sidebottom, Mem. Proc. Manchester Lit. Phil. Soc., vol. 52, 1908, No. 13, pl. 13, figs. 1, 2.

Specimens identical to those recorded by Sidebottom from the Mediterranean occur in small numbers at several localities (samples No. 25, 33 and 35).

Test plano-convex, dorsal side forming a high curve, ventral side slithtly concave, trochoid; sutures oblique, curved steeply, slightly depressed on both the dorsal and ventral sides.

Genus NEOCONORBINA Hofker, 1951
Neoconorbina orbicularis (Terquem)
(Pl. 2, fig. 17)

Rosalina orbicularis Terquem, Anim. sur la Plage Dunkerque, 1876, p. 75, pl. 9, figs. 4a, b.

Discorbis orbicularis Sidebottom, Mem. Proc. Manchester Lit. Phil. Soc., vol 52, No. 13, 1908, p. 3, pl. 4, fig. 7.

Specimens resembling those recorded by Terquem and Sidebottom are found in sample No. 8.

The arrangement of the elongate imbricating chambers where each chamber in the dorsal side makes almost half the circumference of the test together with the acute periphery and concave ventral side distinguish this species. The apertural characters of our specimens are those of the Genus *Neoconorbina* Hofker.

Genus VULVULINERIA Cuhsman, 1926
Vulvulineria cf. V. araucana (d'Orbigny)
(Pl. 2, fig. 21)

Rosalina araucana d'Orbigny, Voy. Amer. Merid., 1839, vol. 5, pt. 5, Foraminifères, p. 44, pl. 6, figs. 16-18.

A few specimens resembling this species are found at sample No. 74. Our specimens differ in having less punctate test and a smaller umbilical area on the ventral side. The type comes from Chile and our record, although coinciding with Colom's in the Western Mediterranean (Instit. Espanol Oceanografia. Notas y Res., ser. 2, No. 96, 1941, p. 18, pl. 5, figs. 104-106) is here assigned tentatively until more specimens are found for further study.

Genus EPONIDES Montfort, 1808
Epondides repandus (Fichtel and Moll)
(Pl. 2, fig. 23)

Pulvinulina repanda H.B. Brady, Rep. Voy. *Challenger*, Zoology vol. 9, 1884, p. 684, pl. 104, fig. 18. — Colom, Instit. Espanol Oceanografia. Notas y Res., ser. 2, No. 108, 1942, p. 39.

This cosmopolitan species is found in very small numbers at only a few localities (samples Nos. 17 and 25). Specimens are typcial although smaller than usual.

Eponides repandus (Fichtel and Moll) var. concameratus (Williamson)
(Pl. 2, fig. 22)

Pulvinulina repanda var. concamerata. H.B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 685, pl. 104, figs. 19a-c.

This ornamented and somewhat umbilicate variety known chiefly from the Eastern Atlantic is found in small numbers in sample No. 22, This variety is more common than the typical species.

Genus STREBLUS Fischer, 1817
Streblus beccarii (Linne)
(Pl. 2, fig. 24)

Rotalia beccarii Cushman, Contr. Lab. Foram. Res., vol. 4, 1928, p. 104, pl. 15.

This species originally described from the Mediterranean and later recorded from many seas is represented in our material by a large number of specimens that occur in samples Nos. 8, 9, 25 and 67

All these samples with the exception of the last occur in the area East of Alexandria and the last sample comes from the extreme western part of the area sampled. It is remarkable that these areas are the only parts where the effect of the Nile water that is discharged in the Mediterranean and the torrents affect the salinity of the waters. *S. baccarii* therefore is considered as an excellent ecological indicator.

Our specimens are exactly similar to those recorded by Cushman from Rimini, the type locality. The *S. baccarii* record in the Red Sea (Said Special Publ. 26, Cushman Lab. Foram. Res., 1949, p. 37) needs revision as it is smaller and with a less ornamented ventral surface. The variety *S. beccarii parkinsoniana* described by Cushman (Bull. Florida Geol. Surv., No. 4, 1930, p. 65) as different from the

typical form in having a fewer number of chambers and in the lack of beading in the ventral side and lack of thickening of sutures in the dorsal side is probably the young form of *S. beccari* (cf. these characters with fig.59, pl.15, Contr. Cushman Lab. Foram. Res., 1928).

Genus MISSISSIPPINA Howe, 1930
Mississippina concentrica (Parker and Jones)
(Pl. 2, fig. 14)

Pulvinulina concentrica Parker and Jones, Ms. in H.B. Brady, Trans. Linn. Soc., London, vol. 24, 1864, p. 470, pl. 48, fig. 14.

A few specimens of this species are found in sample No. 33. With the recording of this species from both the Eastern and Western Mediterranean, this species assumes a cosmopolitan aspect as it has been repeatedly recorded from many modern seas.

Genus SIPHONINA Reuss, 1850
Siphonina tubulosa Cushman
(Pl. 2, fig. 25)

Siphonina tubulosa Cushman, Proc. U.S. Nat. Mus., vol. 72, Art. 20, 1927, p. 10, pl. 1, figs. 3a-c.

A very few typical specimens of this species are found at samples Nos. 22, 25 and 33. The acute distinctly keeled and tubulate periphery distinguish this typically Indo-Pacific species here recorded in the Mediterranean for the first time.

Genus HOGLUNDINA Brotzen, 1948
Hogludina elegans (d'Orbigny)
(Pl. 2, fig. 26)

Epistomina elegans Cushman, Cushman, Lab. Foram. Res., vol. 3, 1927, p. 182, pls. 31, 32.

This typically Tertiary Mediterranean species is found in small numbers at several localities (samples Nos. 17, 20, 30 and 33). It is slightly higher than the common form recorded by many authors.

Family AMPHISTEGINIDAE
Genus AMPHISTEGINA d'Orbigny, 1826
Amphistegina radiata (Fichtel and Moll)

Amphistegina radiata Said, Special Publ. 26, Cuhsman Lab. Foram. Res., 1949, p. 38, pl. 4, fig. 10.

This species occurs in large numbers at a few localities (samples Nos. 35, 58 and 63). It seems to be sorted out in coarse grained sands in associatoin with the representatives of the Family Peneropliidae. Specimens are typical.

Family ANOMALINIDAE
Genus CIBICIDES Montfort, 1808
Cibicides lobatulus (Walker and Jacob)
(Pl. 2, fig. 27)

Cibicides lobatulus Cushman, Bull. 104, U.S. Nat. Mus., pt. 8, 1931 p. 118, pl. 21, figs. 3a-c.

Asmall number of specimens of this species are found in samples Nos. 30, 35 and 63. A review of the synonymy of this species shows that it is cosmopolitan in aspect. The lobulated rounded peiphery, the depressed sutures of the ventral side, the flush but limbate sutures of the dorsal side and the corasely perforate wall distinguish this species.

Cibicides mabahethi Said
(Pl. 2, fig. 28)

Cibicides mabahethi Said, Special Publ. 26, Cushman Lab. Foram. Res., 1949, p. 42, pl. 4, fig. 20.

A few specimens that seem to belong to this species are found in sample No. 8. The numerous chambers (10-12 in number) of the last whorl and the raised boss of the dorsal side distinghuish this species.

Cibicides refulgens Montfort
(Pl. 2, fig. 29.)

Cibicides refulgens Cushman, Bull. 104, U.S. Nat. Mus., pt. 8, 1931, p. 116, pl. 21, fig. 2a-c.

This widely distributed species occurs in large numbers at samples Nos. 8, 9, 17, 22, 25, 33 and 63. Our specimens resemble those recorded from the Mediterranean and the Red Sea regions. The periphery is acute but not keeled as the descriptions and figures of some authors show. The last inflated chamber of the ventral side provides an easy diagnostic feature.

Genus CIBICIDELLA Cushman, 1927
Cibicidella variabilis (d'Orbigny)

Truncatulina variabilis d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 279, No. 8. — Sidebottom, Mem. Proc. Manchester Lit. Philos. Soc., vol. 53, 1909, No. 3, p. 2, pl. 1, figs. 5, 6; pl. 2, figs. 1-3.

This species occurs in small numbers at sample No. 35. The type came from the Canaries and the species is a typical Lusitanian one. Our specimens are typical.

Family PLANORBULINIDAE
Genus PLANORBULINA d'Orbigny, 1826
Planorbulina acervalis H.B. Brady
(Pl. 2, fig. 30)

Planorbulina acervalis H.B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 657, pl. 92, fig. 4.

This cosmopolitan species occurs in small numbers in sample No. 35. It has been recorded from the Mediterranean by Colom in deep water samples. Our specimens are obviously washed and sorted out material.

Planorbulina mediterraensis d'Orbigny
(Pl. 2, fig. 31)

Planorbulina mediterraensis d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 280, No. 2, pl. 14, figs. 4-6.

Typical specimens of this Mediterranean East Atlantic species are recorded from samples Nos. 33 and 35. This species has been recorded from the western Mediterranean by Colom and off the coast of Greece by Sidebottom. It is one of the few Mediterranean species that invaded the Red Sea.

ACKNOWLEDGEMENT

The authors wish to acknowledge their indebtedness to Mr. Maurice Hamawi for his drawing of plate 2.

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EXPLANATION OF PLATE I

All magnifications are x 40

Fig.

1. Textularia agglutinans d'Orbigny
2. T. candeiana d'Orbigny
3. T. gramen d'Orbigny
4. T. sagittula Defrance
5. Clavulina difformis H.B. Brady
6. Quinqueloculina agglutinans d'Orbigny
7. Q. akneriana d'Orbigny

8, 9. Q. bicornis (Walker and Jacob)

10. Q. bicarinata d'Orbigny
11. Q. bradyana Cushman
12. Q. candeiana d'Orbigny
13. Q. carinata d'Orbigny
14. Q. costata d'Orbigny
15. Q. depressa d'Orbigny
16. Q. disparilis d'Orbigny
17. Q. dutemplei d'Orbigny
18. Q. ferussacii d'Orbigny
19. Q. laevigata d'Orbigny
20. Q. lamarckiana d'Orbigny
21. Q. limbata d'Orbigny
22. Q. longirostra d'Orbigny
23. Q. parkeri (H.B. Brady)
24. Q. polygona d'Orbigny
25. Q. pulchella d'Orbginy
26. Q. quadrilaterialis d'Orbigny
27. Q. sclerotica Karrer
28. Q. seminula (Linne)
29. Q. variolata d'Orbigny
30. Q. striata d'Orbigny

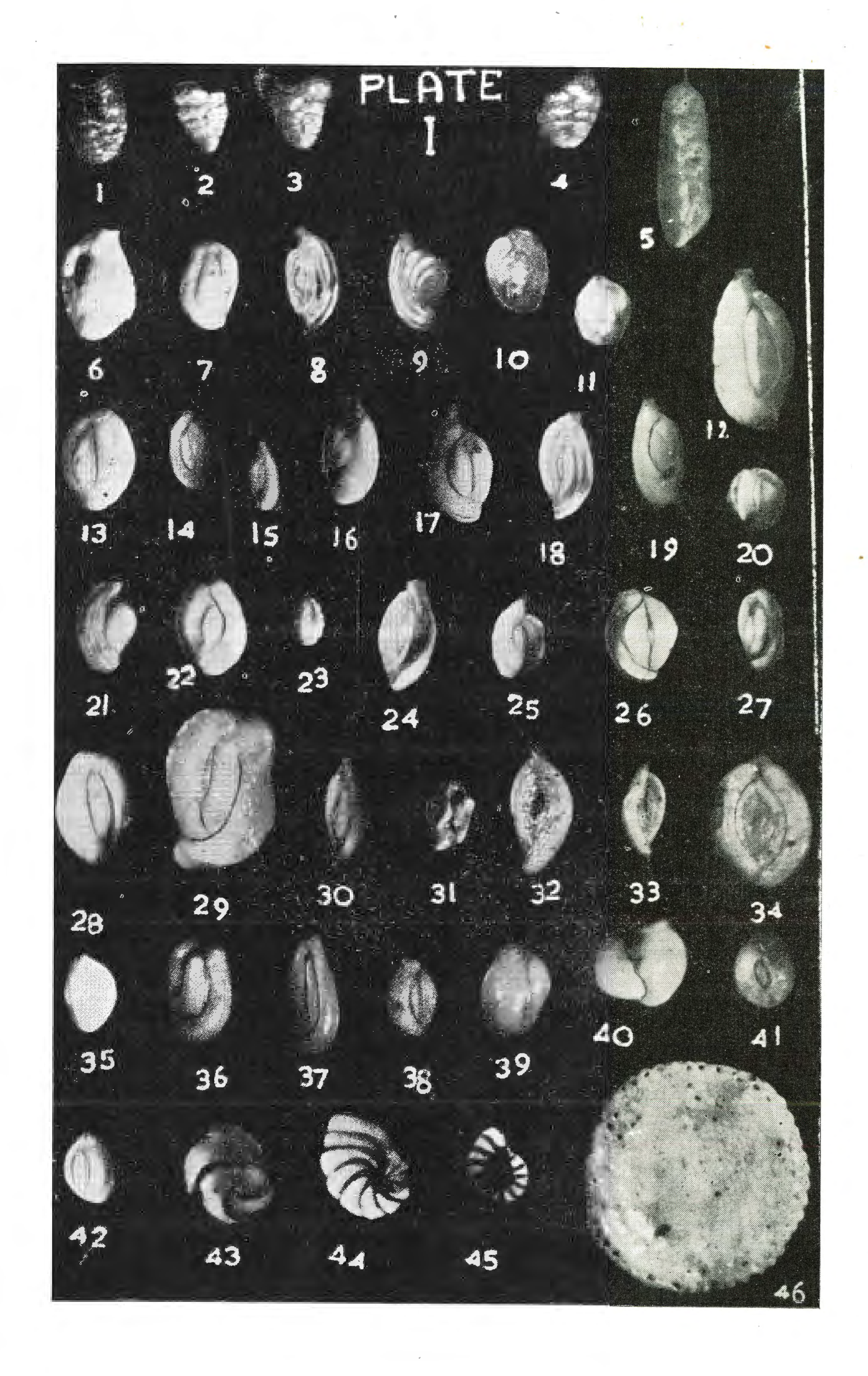
31. Q. undulata d'Orbigny
32. Spiroloculina antillarum d'Orbigny
33. S. canaliculata d'Orbigny
34. S. colomi Said and Kamel, new name
35. Triloculina affinis d'Orbigny
36. T. gibba d'Orbigny
37. T. oblonga (Montagu)
38. T. reticulata d'Orbigny
39. T. rotunda d'Orbigny
40. T. sidebottomi (Martinotti)
41. T. suborbicularis d'Orbigny
42. T. trigonula (Lamarck)
43. Vertebralina striata d'Orbigny

44, 45. Peneroplis pertusus (Forskal)

46. Amphisorus duplex (Carpenter)

EXPLANATION OF PLATE II

FIG.		
1.	Quinqueloculina vulgaris d'Orbigny	x 15
2.	Spiroloculina excavata d'Orbigny	x 15
3.	Triloculina dilatata d'Orbigny	x 15
4.	Robulus gibbus (d'Orbigny)	x 30
5.	Globulina gibba d'Orbigny	x 30
6.	Nonion boueanum (d'Orbigny)	x 30
7.	Nonionella sp.	x 30
8.	Elphidium advenum Cushman	x 30
9.	E. crispum (Linné)	x 30
10.	E. excavatum (Terquem)	x 30
11.	E. macellum (Fichtel and Moll)	x 30
12.	E. maioricense Colom	x 30
13.	Peneroplis planatus (Fichtel and Moll)	x 30
14.	Mississippina concentrica (Parker and Jones)	x 30
15.	Bolivina tortuosa H.B. Brady	x 30
16.	Rosalina globularis d'Orbigny	x 30
17.	Neoconorbina orbicularis (Terquem)	x 30
18.	Loxostomum limbatum H.B. Brady	x 30
19.	Rosalina sidebottomi Said and Kamel, new name	x 30
20.	R. turbo (d'Orbigny)	x 30
21.	Vulvulineria cf. V. araucana (d'Orbingy)	x 30
22.	Eponides repandus (Fichtel and Moll) var. concameratus (Williamson)	x 30
23.	Eponides repandus (Fichtel and Moll)	x 30
24.	Streblus beccarii (Linné)	x 30
25.	Siphonina tubulosa Cushman	x 30
26.	Hoglundina elegans (d'Orbigny)	x 30
27.	Cibicides lobatulus (Warker and Jacob)	x 30
28.	C. mabahethi Said	x 30
29.	C. refulgens Montfort	x 30
30.	Planorbulina acervalis H.B. Brady	x 30
31.	P. mediterraensis d'Orbigny	x 30



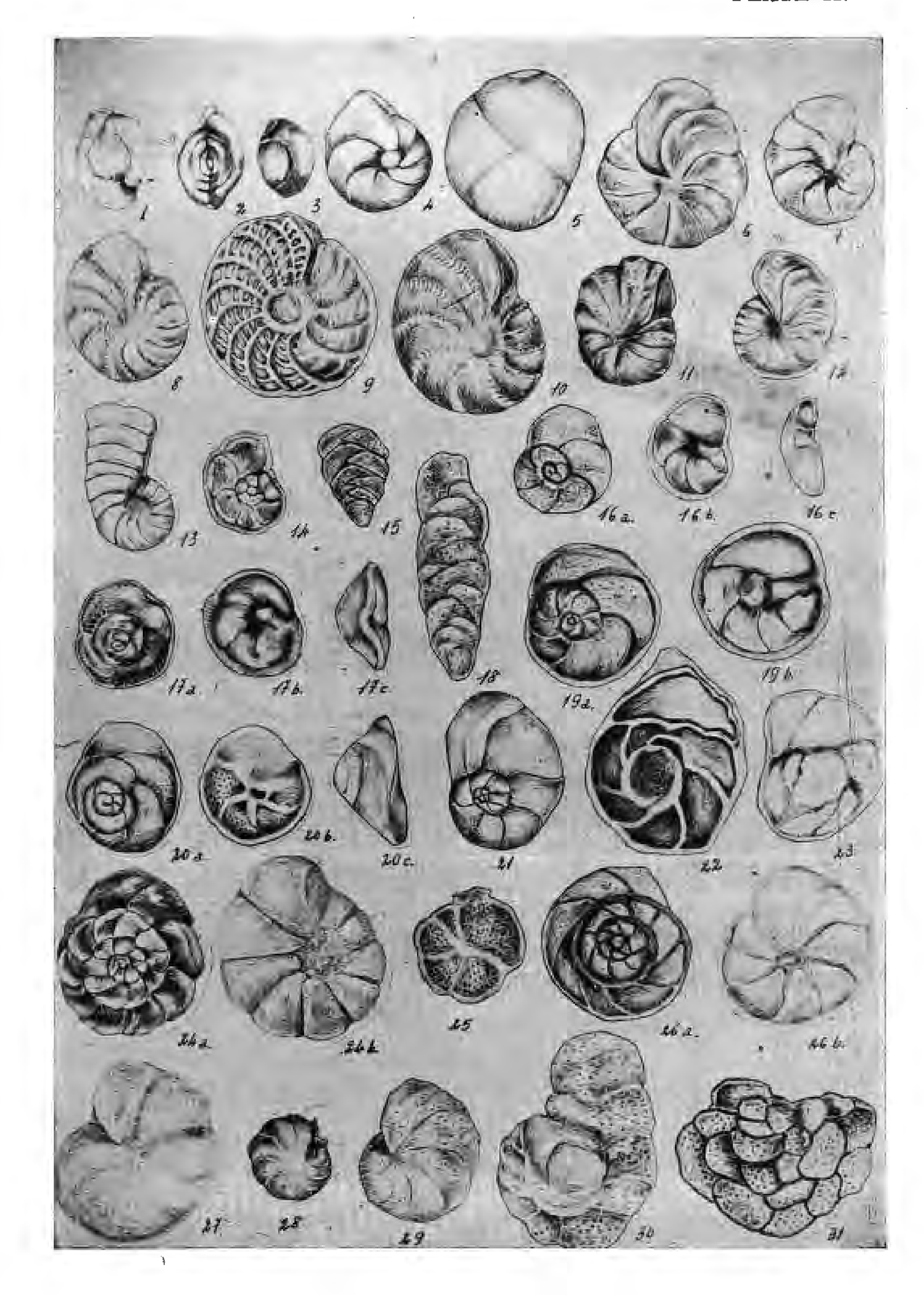
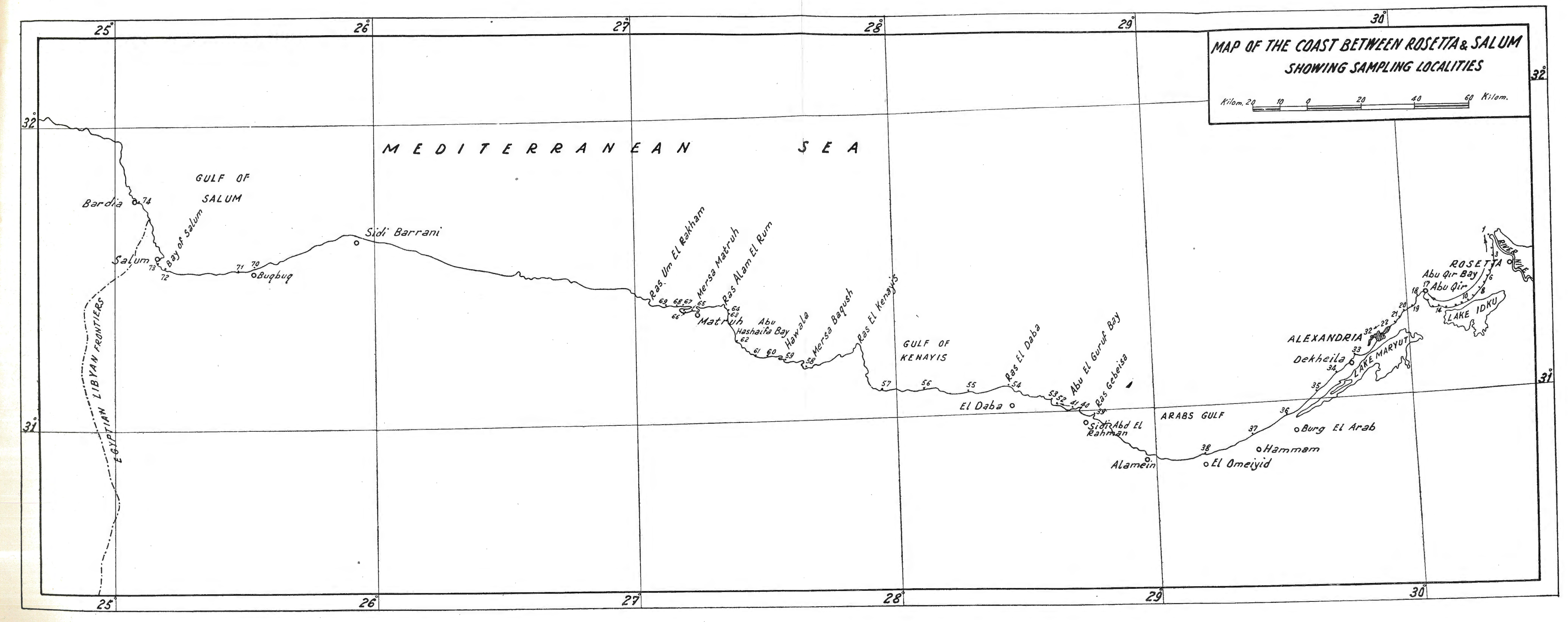

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16a.
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17b.
17c.
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19a.
19b.
20a.
20b.
20c.
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24a.
24b.
25
26a.
26b.
27
28
29
30
31

Fig. 1



MAP OF THE COAST BETWEEN ROSETTA & SALUM
SHOWING SAMPLING LOCALITIES
Kilom. 20 10 0 20 40 60 Kilom.
MEDITERRANEAN SEA
GULF OF SALUM
Bardia
Bay of Salum
Salum
Bugbug
Sidi Barrani
EGYPTIAN LIBYAN FRONTIERS
Ras Um El Rakham
Mersa Matruh
Ras Alam El Rum
Matruh
Abu Hashaifa Bay
Hawala
Mersa Baqush
Ras El Kenayis
GULF OF KENAYIS
Ras El Daba
El Daba
Abu El Guruf Bay
Ras Gebeisa
Sidi Abd El Rahman
Alamein
ARABS GULF
El Omeiyid
Hammam
Burg El Arab
Dekheila
ALEXANDRIA
LAKE MARYUT
LAKE IDKU
Abu Qir
Abu Qir Bay
ROSETTA
RIVER NILE

The Geology of the Mediterranean Coast Between Rosetta and Bardia

Part I: Recent Sediments: Mechanical Analysis and Mineral Composition

By

N.M. SHUKRI and G. PHILIP

I. INTRODUCTION.

This paper deals with the mechanical analysis and mineral composition of the beach sediments of the Mediterranean coast line from the mouth of the River Nile at Rosetta, Egypt, to Bardia, Libya, some twenty-five kms. to the west of the Egyptian-Libyan frontiers. The Pleistocene sediments will be dealt with in Part II and III.

In a previous work, Hilmy (1951) examined a few samples from the shore between Rosetta and Matruh and showed that the heavy minerals decrease westwards. He also gave some analyses of the carbonate content of the sediments and of their mechanical constitution.

In the present investigation some one hundred and eighty samples were collected along this six hundred and fifty kilometer stretch of the Mediterranean shore line lying between longitudes 25° 5′ E and 30° 20′ E.

The shore line can be divided according to its geomorphology and the nature of its sediments into four different zones. The first zone, the Abu Qir Bay, extends for about forty-five kms. from the mouth of the River Nile at Rosetta westwards to Abu Qir. From this stretch forty samples were collected at intervals ranging from one to three kms. In this area there are some small inland lakes separated from the sea by narrow strips of land. The sediments of this area are mixed to a great extent with the Nile silt which imparts a greyish colour to the sands.

Geomorphologically the first zone is shaped largely by terrestrial depositional agencies (Shepard, 1948). Here the River Nile contributes

great amounts of material to the shore especially during flood time. The shore line has numerous outbends and peripheral deltaic lagoons.

The River Nile deposits, which flow into the Mediterranean through the Rosetta and Damietta branches, are carried towards the east by long shore currents that hit the coast obliquely in a north westerly direction, thereby transporting most of the sediments of the Nile eastwards of the area under discussion. However, contamination by the River Nile sediments is still to be detected in sizable quantities in this zone.

The second zone comprises the beaches of Alexandria city between Abu Qir and Dekheila; it extends for about thirty-five kms. Some forty-five samples were collected from fifteen sampling sites along this stretch. The coast line of this zone exhibits typical features of a youthful shore line. Sandy limestone cliffs border it at many localities and the shore line is made of protected bays sheltered from the open sea by small islets. The sediments in this area are still contaminated to a small extent by the Nile sediments, and shell fragments constitute a good portion of their composition.

The third zone extends from west of Dekheila to about thirteen kms. east of Saloum city for a distance of about five hundred and twenty-five kms. About ninety samples were collected from this area. The shore between ten kms. west of Matruh and forty three kms. east of Saloum was not sampled. The shore line in this third zone is made of a large number of open bays the most pronounced of which is the Gulf of Arabs in the east and the Gulf of Saloum in the west. In between these two gulfs there are numerous smaller bays separated by points that protrude into the sea. These alternating headlands and bays seem to be related to some regional structural features.

There are a few prominent sea-stacks best developed in the area west of Matruh (pl. 1, fig. 2). Along this shore line peripheral lagoonal lakes are few, and, on the whole, far between. Pumice is found scattered all over the beach and is thought to have drifted from southern Europe. The beach sediments in this zone are formed of oolitic calcareous grains derived from the old bars that border the coast.

The fourth zone extends from near Saloum city westwards at least to Bardia. In this zone the beach is bordered by wavecut Miocene-Pliocene cliff at different levels, the highest level of which is at 200 meters. This cliff contributes a great part of the

sediments and these are carried by comparatively large consequent streams. Three samples were examined for their heavy minerals from this stretch.

Geomorphologically the second, third and fourth zones have shore lines that were primarily shaped by marine erosion. In the second zone the raised coast was made irregular by wave erosion and is characterised by prominent points and small bays. In the third zone, however, although this pattern of prominent points and small bays is known to exist at several localities, the dominating freature is the fact that the sea cliffs, when present, are straightened by wave erosion (pl. I, fig. 1). In the fourth zone the cliff bordering the shore is very close to it and is cut by numerous wadies. The cliffs in this zone are higher and are made of older sediments than those in the previous zones. The strata here are made of Pliocene and Miocene sediments which are, in places, very much disturbed apparently by slumping. This seems also to be the case with the Miocene sediments at Bardia described by Knetsch (1942).

II. SAMPLING

From each sampling site (Fig. 1) a number of samples ranging from one to three were collected. These were marked A, B and C, "A" denotes a sample covered by water all the time. Samples marked "B" were taken from the zone lying between the low and high water lines of the fore shore, while samples "C" were taken from the coastal dunes at the back shore. Samples of about 500 gms. each were collected mostly by forcing a cylindrical tube, 15cms. in length, in the recent sediments at the sampling locality.

III. MECHANICAL ANALYSIS

One hundred and seventy one samples from the three environments, namely 62 "A" samples, 65 "B" samples and 44 "C" samples were examined.

The analysis was carried out by the sieving method. Each sample examined was quartered using a Jones sample splitter and about 25 gms. were screened through a set of "Tyler" standard sieves (meshes Nos. 4, 8, 16, 28, 48, 100 and 250 with the corresponding openings of 4.760, 2.362, 1.168, 0.589, 0.149 and 0.062mms.). A "Ro-tap" shaker was used for about 15 minutes. Cumulative curves

were drawn and from them data for histograms according to Wentworth scale were determined.

From the cumulative curves the median diameter Md, the first and third quartiles Q_1 and Q_3 were determined. Sorting coefficient $SO = \sqrt{\frac{Q1}{Q3}}$, skewness $Sk = \frac{Q1 \times Q3}{(Md)^2}$, and arithmetic quartile deviation $QDa = \frac{Q1 - Q3}{2}$ were calculated from the data obtained.

The results of mechanical analyses and the statistical constants of the three eviroments sampled are given in table I. The majority of sediments possess median diameters that vary between 0.6 and 0.15 mm. The sediments are very well sorted with sorting cooficients ranging in the main from 1.1 to 1.4. They are also symmetrical, the majority possessing skewness coefficients that vary between 0.95 and 1.20.

Plotting the median diameters against sorting, the median diameters against skewness and sorting against skewness it was found that the same relations exist in the three different environments of the recent sediments.

No apparent relation between sorting and median diameter was detected in the examined samples. The best sorted sediments were not necessarily those having a median diameter of about 0.18 mm. as in some other cases (Shukri and Higazy, 1944, p. 61 and fig. 16 and Inman, 1949, p. 51 and fig. 1). This is explained by the fact that the present sediments are beach and dune sands which are very well sorted (their sorting varying within a small range) irrespective of their median diameter.

A median diameter against skewness graph showed that there is a tendency for some of the coarser sediments to be negatively skewed (Sk less than 1) and for some of the finer sediments to be positively skewed (Sk more than 1), while the majority of the symmetrical samples (Sk = 1) possess a median diameter that ranges between 0.15 and 0.28.

A sorting against skewness graph showed that the less sorted sediments are more skewed and that skewness decrease with the increase of sorting.

Table I shows also that the sediments of the three environments are to a great extent similar. This is interesting as it shows that the mechanical analysis is not always useful in elucidating the environmental conditions of deposition of ancient sediments. The similarity

of the mechanical constitution of the sediments of the three environments seems to be due to the fact that the samples of the shore dunes ("C") are so close to the sea that they mix freely with the "B" low-high water lines beach samples and with the "A" under water samples and to the fact that the "B" samples are blown into the dunes. This is in harmony with the results of Twenhofel (1941). In the second zone (Alexandria – Dekheila), however, the dune samples are better sorted than the beach samples. This may be due to the effect of the presence of shell fragments in the beach sands and to the fact that the dunes in this zone are situated away from the shore.

Table I shows also that the sediments of the three zones between Rosetta and Saloum are more or less similar except that the beach samples in the first zone (Abu Qir Bay) are finer than those in the two other zones. This difference may be attributed to a difference in their source rocks; the detrital material of the first zone (mostly Nile sediments) is conspicuously different from those in the other zones (mostly of oolitic calcarious sands of the old bars).

Detailed sampling from as many sedimentation units as possible from the middle area of Abu el Guruf (thirty-five samples from a stretch three kilometers long) was undertaken to find out if there was any effect of micro geomorphological features on the mechanical constitution of the sediments. No apparent relation was established probably because the statistical constants of the sediments vary but little as mentioned previously.

IV. MINERAL ANALYSIS.

Heavy mineral separation was carried out in bromoform (sp. gr. = 2.85). About twenty grams of each sample were used in the separation. The heavy crops were weighed and the index figures were calculated. After quartering, a thin spray was spread on a slide using canada balsam as a mounting medium. About three hundred grains were counted for each sample and the percentages of each mineral were calculated.

The results of the mineral analyses are shown in Table II, which gives the relative frequencies of heavy minerals examined from the Recent sediments in the four zones previously discussed in chapter I. The percentage of each member of the non-opaque minerals is calculated on the basis that the non-opaques form one hundred per cent. Fig. 2, shows diagramatically the relative frequencies of some of the most common minerals plotted against their localities.

The different subdivisions of the coast line based on geomorphological grounds show also distinct mineral assemblages. In the following lines the mineralogy of the recent sediments in the different zones are discussed.

Minerals of the Light Fraction :

At Rosetta, where the carbonate content is minimum, quartz, orthoclase, microcline, plagioclase felspars and muscovite constitute the light fraction. Farther west, calcium carbonate is introduced either in the form of shells or shell fragments as in the first and second zones or in the form of oolites as in the third zone. In the third and fourth zones quartz constitutes the bulk of the light fraction, which is much poorer in felspars than in the first zone.

Minerals of The Heavy Fraction :

A. *First and Second Zones* (*Rosetta — Abu Qir — Dekheila*).

Seventeen samples were studied from the first and second zones for their heavy mineral content. The assemblage of minerals in the two zones is more or less the same and no separation by means of the relative frequencies of their minerals alone was possible and thus were treated as one unit. However, they are clearly distinguishable one from the other by means of their index figures which conspicuously decrease from east to west. The sediments at Dekheila are clearly poorer in the amount of heavy minerals than those at Abu Qir. In the two zones the assemblage is similar to that of the Egyptian part of the Nile sediments (Shukri, 1951). The assemblage is characterised by high frequencies of pyroxenes, amphiboles and epidotes and a low percentage of tourmaline (average 1. 1%) and zircon (average 2.4%). The pyroxenes are represented mostly by yellow and brownish-violet titaniferous varieties of augite and hypersthene, forming some 25% of the heavy minerals. These varieties are identical to those derived from the Abyssinian Plateau. The amphiboles form some 40% of the heavies and are represented, in the main, by dirty green and bluish green varieties of hornblende, some members of the fibrous tremolite-actinolite series and glaucophane. These varieties are known in the Nile sediments. Epidotes are also high in frequency ranging from 17.8 to 40.2 with an average of 26.2%. They are

represented by pistachite, zoisite and clinozoisite. There is a trend for the epidotes to be less abundant towards the west. The iron ores make a good portion of the mineral constitution of the sediments of the two zones. They range from 13.1 to 63% with an average of 27.2% and are represented by magnetite, ilmenite, haematite and limonite.

It is interesting to notice that the effect of selection during transportation of the Nile sediments westward is shown by the relative decrease of the epidotes and the violet brown variety of augite to the west, while the more flaky yellow augite and hornblende increase in the same direction. Pettijohn and Ridge, (1933) also noticed a similar result. On the other hand there seems to be no trend in the frequency of the iron ores as they fluctuate only at random.

It is of interest to notice that apatite, sphene, monazite and sillimanite, all known from the Nile sediments, are recorded only from this part of the shore and are absent farther west.

The mineral assemblage of the area is controlled by both the source rocks and the position of the samples. The source rocks are mostly Nile sediments which decrease westwards. The effect of location of the samples is shown by the fact that sediments of the open bays have a low frequency of the flaky minerals and a high frequency of the granular grains. Sample 20, for instance, collected from the open sea at Maamoura has a low frequency of amphiboles and higher frequencies of iron ores, zircon, tourmaline and epidotes.

B. *Third Zone* (*Dekheila — 13kms. east of Saloum*).

The carbonate content of this zone is very high (average of 96.7%) and the use of bromoform alone to obtain enough amount of heavy crop was accordingly insufficient. The sample was therefore treated with acetic acid (1: 8) and the residue was separated in bromoform. Sixteen samples were studied from this zone for their heavy mineral content. This zone is characterised by greater frequencies of the more stable minerals tourmaline and zircon, the first ranging from 11.1 to 80.6% with an average of 34%, while the second ranges from zero to 32.3% with an average of 12.5%. Zircon and tourmaline increase abruptly at Dekheila and westwards, an influx which affects the percentage of other minerals adversly. Here tourmaline is present in a variety that is pleochroic from reddish-brown to dark green, that was not recorded to the east of Dekheila.

The typical Nile sediments here disappear nearly completely. Augite becomes scarce varying from 1.2 to 23.3% with an average of 8.5%. It is represented by a clear variety with shades of light green different from the Nile varieties. Epidotes are mostly represented by pistachite, while zoisite and clinozoisite are few in this zone.

This zone is further distinguished from the first and second zones by having a very poor heavy mineral crop and the index figures average less than 0.01%. This is in contrast with the previous two zones in which the index figures are relatively higher (11.5 at Rosetta and 0.2 at Dekheila). This is due to the effect of contamination from the Nile sediments as mentioned previously.

The decrease in index figures is accompanied by an increase in the carbonate content (Hilmy, 1951). Samples from the first zone in the present work are the poorest in carbonates (average of 24.5%) compared with those of the second zone (average of 76.9) and the third zone (average of 96.7%).

The source rocks of the Dekheila — Saloum zone are the calcareous bars that border the shore line in this area which are subjected to marine attrition and wave action. (Shukri, Philip and Said, 1955, Part II.) This is confirmed by the fact that the ten meters coastal bar in this zone gave an indistinguishable assemblage. (Shukri and Philip, 1955, part III.)

C. *Fourth Zone* (*East of Saloum — Bardia*).

Three samples were studied from this zone. Here the heavy minerals are more related to the third zone than to the first and second zones. Fig. 2 shows that this zone is distinct from the third zone by a decrease in both pyroxenes and amphiboles, an increase in rutile and an abundance in staurolite as regards both average percentage and the number of samples in which it is present. Moreover new, red, blue and brown varieties of tourmaline in the form of rounded grains appear. These rounded grains are similar to those recorded from the Nubian Sandstone (Shukri and Said, 1945).

The index figure is nearly the same as in the third zone, while the carbonate content decreased greatly (average of 30%).

The source rocks in this area seem to be the Pliocene - Miocene cliffs which are dissected by consequent streams that flow to the shore in this zone. These sediments probably contributed the rounded varieties of tourmaline, which may have ultimately been derived from the Nubian Sandstone itself in the south.

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PLATE I



Fig. 1. — Cliff in 25 m Abu Sir bar, at Abu Girab, 176 kms. west of Alexandria.

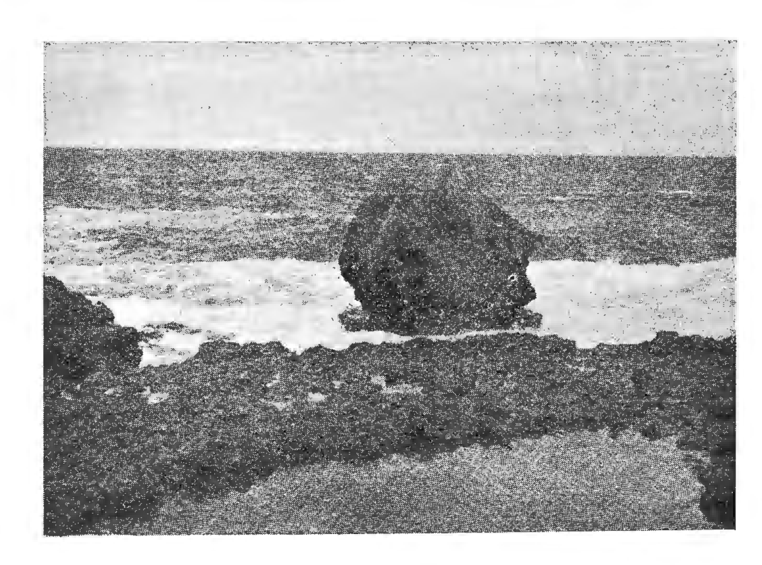


Fig. 2. — Sea-stack at Saloum.

TABLE I

STATISTICAL CONSTANTS OF BEACH SANDS - MEDITERRANEAN COAST

The samples are arranged from east to west

No. of Locality and Sample	LOCALITY	"A" Samples						"B" Samples						C" Samples						Carbonate content of "B" Sample %
		Q1	Md	Q3	So	QDa	Sk	Q1	Md	Q3	So	QDa	Sk	Q1	Md	Q3	So	QDa	Sk	
	FIRST ZONE (ROSETTA TO ABU QIR CITY)																			
1	Mouth of Nile at Rosetta..........................	160	170	190	1.090	015	1.052	160	170	190	1.090	015	1.052							2.4
2	Abu Qir Bay	148	170	195	1.148	023	998	165	180	210	1.128	022	1.069							
3	Abu Qir Bay, 3 kms. west of locality 2	140	160	190	1.165	025	1.035	160	190	220	1.173	030	0.975							
4	Abu Qir Bay, 3 kms. west of locality 3	155	175	220	1.192	032	1.113	145	164	190	1.145	022	1.024							4.1
5	Abu Qir Bay, 3 kms. west of locality 4	170	190	220	1.138	025	1.036	140	160	180	1.134	020	0.984							
6	Abu Qir Bay 3 kms west of locality 5	130	155	185	1.193	027	1.002	133	160	195	1.211	031	1.012							
7	Abu Qir Bay 3 kms. west of locality 6	130	160	206	1.259	038	1.046	130	170	230	1.330	050	1.034	140	160	180	1.134	020	0.984	11.5
8	Abu Qïr Bay, 3 kms. west of locality 7	110	145	210	1.414	050	1.098	120	150	195	1.250	035	1.084							
9	Abu Qir Bay, at Meadia	130	170	250	1.387	060	1.124													
10	Abu Qir Bay west of locality 9	230	260	300	1.142	035	1.020	230	260	320	1.180	045	1.088	210	230	260	1.112	025	1.032	36.1
11	Abu Qir Bay west of locality 10	200	250	340	1.304	070	1.088	210	230	260	1.112	025	1.032	210	210	230	1.046	010	1.120	
12	Abu Qir Bay west of locality 11	140	174	230	1.282	045	1.063	230	300	500	1.474	135	1.277	210	230	250	1.091	020	0.992	44.9
13	Abu Qir Baywest of locality 12	162	200	280	1.315	059	1.134	160	200	290	1.346	065	1.160	200	240	320	1.265	060	1.111	
14	Abu Qir Bay west of locality 13	140	175	220	1.254	040	1.005	130	230	300	1.291	060	1.020	195	225	300	1.240	052	1.156	
15	Abu Qir Bay, at Tabiet el-Raml	145	166	195	1.160	025	1.026	170	230	330	1.393	080	1.060	200	250	350	1.323	075	1.120	49.0
16	Abu Qir Bay, western end	140	210	440	1.773	150	1.390	160	220	250	1.250	045	826	150	170	190	1.125	020	0.986	21.4
17	Abu Qir City.	160	200	250	1.250	045	1.000	160	200	330	1.434	085	1.320							26.2
	Average	152	184	242	1.245	043	1.072	166	201	261	1.247	047	1.069	189	227	260	1.167	035	1.062	24.5
	SECOND ZONE (ABU QIR CITY TO DEKHEILA)																			
18	El-Moaskar	220	300	550	1.581	165	1.344	220	240	300	1.168	040	1.145	220	235	300	1.168	040	1.195	57.5
19	Tabiet-el-Tewfiquia	790	1.100	1.740	1.484	475	1.136	420	550	760	1.345	170	1.055	530	630	760	1.198	115	1.014	
20	El-Maamoura	250	280	360	1.200	055	1.148	255	280	360	1.188	053	1.043	230	300	400	1.322	085	1.022	72.1
21	El-Mandara, Alexandria	240	280	390	1.275	075	1.194	230	270	340	1.234	055	1.072	180	200	220	1.106	020	0.990	78.5
22	Alexandria at Sidi Bishr No. 3	140	190	280	1.414	070	1.028	320	670	1.200	1.937	440	0.853	230	280	350	1.234	060	1.026	
23	Alexandria at Sidi Bishr No. 2	190	230	300	1.256	055	1.079	210	280	400	1.380	095	1.071	180	240	350	1.394	085	1.094	
24	Alexandria at Sidi Bish No. 1	175	225	330	1.373	078	1.163	190	250	360	1.376	035	1.078	160	180	210	1.146	025	1.037	
25	Alexandria at El-Sarayia	190	230	300	1.258	055	1.079	230	300	440	1.383	105	1.124	230	300	440	1.383	105	1.124	
26	Alexandria at San-Stephano	550	640	840	1.236	145	1.103	530	600	720	1.166	095	1.060	450	500	530	1.085	040	0.954	
27	Alexandria at Glymonopolo	630	760	910	1.200	140	0.992	460	500	630	1.175	085	1.159	440	520	660	1.225	110	1.073	80.3
28		660	830	1.100	1.289	220	1.053	500	570	700	1.186	100	1.077	540	630	760	1.187	110	1.030	
29	Alexandria at Staneley.............................	600	800	900	1.226	150	0.843	525	590	630	1.095	052	0.950	440	500	600	1.168	080	1.056	
30	Alexandria at Sporting	350	550	960	1.656	305	1.111	200	250	400	1.414	100	1.280	220	240	276	1.120	028	1.054	
31	Alexandria at Shatby	210	240	330	1.253	060	1.203	250	276	360	1.200	055	1.181	200	230	276	1.175	038	1.043	
32	Alexandria at Silsila	210	230	300	1.195	013	1.190	210	210	220	1.024	005	1.048	190	200	210	1.074	100	0.997	89.7
	Average	360	457	639	1.328	137	1.111	320	456	521	1.285	099	1.079	299	350	417	1.199	069	1.047	76.9

TABLE I. (cont.)

No. of Locality and Sample	LOCALITY	"A" SAMPLES						"B" Samples						"C" Samples						Carbonate content of "B" Samples %
		Q1	Md	Q3	So	QDa	Sk	Q1	Md	Q3	So	QDa	Sk	Q1	Md	Q3	So	QDa	Sk	
	THIRD ZONE (DEKHEILA TO SALOUM)																			
34	Sidi Kreir													260	330	480	1.359	110	1.146	
35	El Dera'a							370	525	620	1.249	125	0.832	260	330	440	1.301	090	1.050	99.9
36	Burg Abu Sir							250	300	370	1.216	060	1.028	360	585	690	1.384	165	0.729	99.9
37	El Hammam	350	460	660	1.373	155	1.090	350	440	630	1.342	140	1.131	260	245	330	1.127	035	1.430	99.9
38	El Emaied light-house	525	570	690	1.146	082	1.114	480	525	630	1.146	075	1.091	380	470	600	1.258	110	1.032	99.9
39	Ras Gebeisa	145	190	275	1.378	065	1.527	240	270	330	1.173	045	1.086	250	300	380	1.233	065	1.055	99.8
40	5 kms. east of Abu-el-Guruf Bay.	460	630	830	1.344	185	0.962	380	440	500	1.147	060	0.978	220	225	230	1.022	050	0.999	99.8
41	Abu-el-Guruf Bay — Eastern Bay	150	190	250	1.291	050	1.038	220	280	440	1.414	110	1.107	220	240	250	1.066	015	0.955	
42	Abu-el-Guruf Bay — West of loc. 41	230	250	320	1.179	045	1.177													
43	Abu-el-Guruf Bay — West of loc. 42 facing sea	145	180	230	1.260	093	1.029													
43a	Abu-el-Guruf Bay — Sheltered by rock	240	295	500	1.441	130	1.383	200	220	240	1.095	020	0.985							
44	Abu-el-Guruf Bay — Eastern Head	145	166	200	1.175	275	1.050	240	295	360	1.225	060	0.993	210	220	230	1.047	050	1.000	
45	Abu-el-Guruf Bay — Middle Bay	330	600	900	1.652	285	0.802	250	360	600	1.550	175	0.864	250	330	500	1.414	125	1.148	
		210	280	600	1.690	195	1.581	250	330	570	1.510	160	1.309							
46	Abu-el-Guruf Bay — West of loc. 45	190	230	300	1.257	055	1.075	240	280	390	1.275	075	1.164							
47	Abu-el-Guruf Bay — West of loc. 46	160	200	295	1.370	070	1.200	230	280	360	1.251	065	1.057							
48	Abu-el-Guruf Bay — West of loc. 47	145	166	190	1.144	022	1.000	270	440	760	1.345	245	1.059							
49	Abu-el-Guruf Bay — Middle Head	140	160	180	1.134	002	0.984	250	290	410	1.281	080	1.218							
50	Abu-el-Guruf Bay — Western Bay	135	150	174	1.135	195	1.177													
		640	870	1.115	1.320	237	0.943													
		165	180	210	1.128	225	1.068													
51	Abu-el-Guruf Bay — West of loc. 50	400	520	800	1.414	200	1.185	170	180	200	1.085	015	1.048	200	190	200	1.000	000	1.185	
52	Abu-el-Guruf Bay — Western Head	280	360	630	1.500	175	1.361	250	350	550	1.483	150	1.122							
53	Ras Tenoum							940	950	960	1.011	010	0.999	250	300	330	1.149	040	0.916	
54	Mersa el Dabaa							260	300	360	1.177	050	1.040							99.7
55	Mersa Abu Samra							500	600	830	1.288	165	1.125	440	500	510	1.077	035	0.897	99.7
56	Ras el Gharquan	230	250	320	1.180	045	1.177	180	190	240	1.197	030	1.150	230	240	250	1.042	010	0.998	
57	Mersa el Kanayis	330	420	600	1.348	135	1.122	530	600	720	1.166	095	1.060							99.0
58	Mersa Baqush	145	155	230	1.287	047	1.388	150	140	174	1.077	012	1.337	200	227	300	1.225	050	1.164	94.0
59	Ras Hawala	230	300	460	1.414	115	1.175	230	240	260	1.063	015	1.038	160	170	230	1.199	035	1.342	89.2
60	3 kms. est of el Kassaba							470	520	630	1.158	080	1.070							94.7
61	El Kassaba	260	320	460	1.330	100	1.168	440	500	570	1.138	065	1.003	240	270	330	1.173	045	1.086	
62	Garawla	170	230	240	1.188	035	0.771	180	200	210	1.080	015	0.945							83.7
63	Alam el Rum	250	295	500	1.414	125	1.450	175	230	300	1.309	065	0.992							
	Alam el Rum (coarse variety)							400	700	1.780	2.209	690	1.453							
64	Alam el Rum — North of loc. 63							250	300	400	1.265	075	1.111							
65	Mersa Matruh (Harbour)	250	275	325	1.140	038	1.074	250	250	250	1.000	000	1.000	290	330	400	1.180	055	1.172	99.0
66	Lake beach, Matruh	270	290	330	1.105	030	1.058	270	300	350	1.138	040	1.050							99.0
67	Open sea, Matruh							480	600	780	1.275	150	1.040	290	320	360	1.114	035	1.019	
69	10—kms. west of Matruh	400	500	690	1.314	145	1.104	250	300	360	1.200	055	1.000	200	205	230	1.072	015	1.117	
	Average (excluding Abu-el-Guruf samples)	290	350	480	1.296	093	1.155	350	400	480	1.107	092	1.066	265	310	373	1.169	059	1.072	96.7
	FOURTH ZONE (SALOUM TO BARDIA)																			
72	5. Kms. east of Saloum							180	200	260	1.202	040	1.171							28.5
73	In front of Halfaya-Saloum Cemetry							240	260	310	1.136	035	1.109							31.5
74	Bardia-Libya							240	250	270	1.061	015	1.036							
	Average							220	237	280	1.133	030	1.102							30.0

TABLE 11

RELATIVE FREQUENCIES OF HEAVY MINERALS OF SAMPLES OF MEDITERRANEAN COAST BETWEEN ROSETTA AND BARDIA

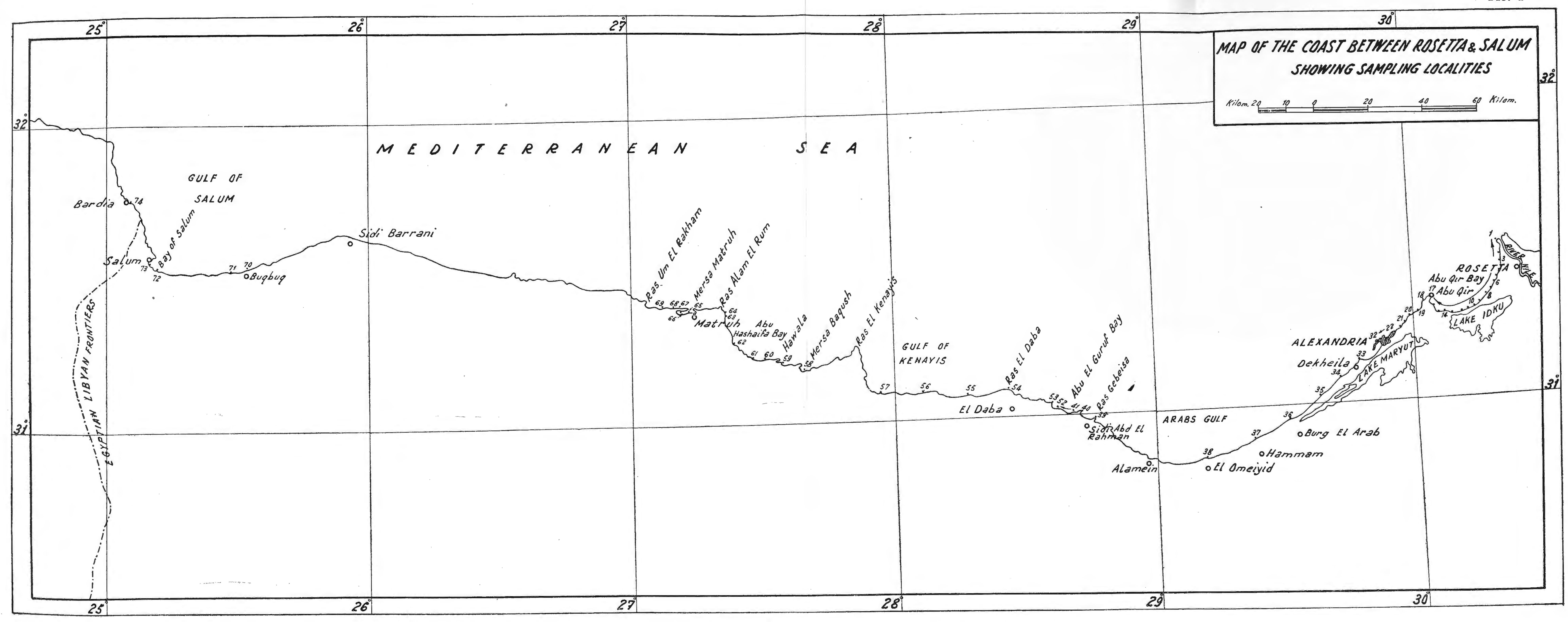
Samples arranged from East to West.

No. of locality and Sample	LOCALITY	Iron ores *	Amphiboles	Pyroxenes	Epidotes	Tourmaline	Garnet	Staurolite	Zircon	Rutile	Kyanite	Biotite	Apatite	Titanite	Monazite	Sillimanite	Index Figure
	FIRST & SECOND ZONES (ROSETTA - ABU QIR - DEKHEILA)																
1	Rosetta, mouth of the Nile	43.2	26.4	30.4	34.8	X	1.5	—	1.9	1.0	1.0	X	X	—	1.0	X	11.5
3	Abu Qir Bay	39.9	34.9	22.6	33.6	1.4	1.8	X	2.3	X	—	—	X	—	X	—	7.8
4	Abu Qir Bay	36.7	35.5	33.8	24.1	1.3	1.7	—	1.7	X	—	X	X	—	—	—	5.6
5	Abu Qir Bay	20.0	41.8	24.9	29.6	—	X	—	1.6	X	—	X	X	—	—	—	5.7
6	Abu Qir Bay	19.6	31.8	22.8	40.2	X	—	—	X	—	X	3.2	—	—	—	—	7.5
7	Abu Qir Bay	21.5	40.0	25.3	30.5	X	—	—	X	—	—	8.4	—	—	—	—	2.6
10	Abu Qir Bay	13.1	49.2	20.4	27.3	—	X	—	X	X	X	X	X	—	—	—	1.4
12	Abu Qir Bay	15.9	53.5	18.9	23.1	—	X	X	1.1	X	—	—	1.5	—	—	—	1.5
15	Abu Qir Bay	37.6	39.4	20.3	28.4	1.3	3.0	X	5.0	1.3	—	X	—	—	—	—	
16	Abu Qir Bay	20.0	42.5	22.0	30.6	X	1.2	X	1.2	X	—	X	—	—	X	—	
17	Abu Qir City	17.7	47.6	25.0	23.8	X	1.2	—	X	X	X	X	—	—	X	—	2.9
18	El Moaskar, west of Abu Qir	33.4	39.8	30.7	17.8	2.6	4.3	X	2.2	—	X	—	X	X	—	X	
20	El Maamoura	63.0	23.0	23.0	19.7	—	12.9	1.3	15.5	4.0	X	—	—	—	—	—	1.8
21	El Mandara, Alexandria	13.9	53.7	21.8	19.4	X	1.4	1.5	X	X	X	—	—	X	—	X	0.2
27	Glymonopolo, Alexandria	22.5	52.8	20.4	19.6	2.0	1.6	X	1.6	X	X	—	—	—	—	—	0.03
32	El Selsela, Alexandria	17.8	38.2	32.8	23.2	—	1.5	X	X	1.1	—	X	—	X	—	X	0.3
33	Dekheila	27.3	35.0	28.6	31.3	8.6	—	X	3.2	1.8	—	X	—	—	—	—	0.2
	Average	27.2	40.3	24.9	26.2	1.1	2.0	X	2.4	X	X	X	X	X	X	X	
	THIRD ZONE (DEKHEILA - 13 Kms. EAST OF SALOUM)																
35	El Deraa	42.0	40.0	12.3	13.0	15.4	—	—	12.3	4.6	—	1.5	—	—	—	—	
36	Burg Abu Sir	40.0	20.8	12.5	4.2	54.5	—	4.2	—	4.2	—	—	—	—	—	—	
37	El Hammam	33.0	52.5	3.3	11.5	11.5	—	—	18.0	1.6	1.6	—	—	—	—	—	
38	El Emaied lighthouse	38.6	37.2	11.4	8.6	31.5	2.8	—	2.8	5.7	—	—	—	—	—	—	
39	Ras Gebeisa	50.5	17.7	7.6	14.6	43.0	X	1.3	12.0	1.9	—	—	—	—	—	—	
40	5 Kms East of Abu El Guruf Bays	42.8	10.4	7.1	15.8	53.0	3.3	X	7.1	2.7	—	—	—	—	—	—	
54	Mersa El Dabaa	48.2	6.5	2.9	7.0	80.6	—	X	1.8	X	—	—	—	—	—	—	
55	Mersa Abu Samra	55.3	14.5	16.0	20.6	38.9	—	X	4.6	3.8	X	—	—	—	—	—	
57	Mersa El Kanayis	62.4	14.2	15.0	13.3	36.7	3.3	X	11.7	5.0	—	—	—	—	—	—	
58	Mersa Baqush	50.7	19.4	7.4	20.5	26.2	3.4	2.2	18.2	2.2	X	—	—	—	—	—	
59	Ras Hawala	59.6	19.7	8.3	22.9	15.3	1.9	1.3	27.8	2.2	X	—	—	—	—	—	
60	3 Kms. East Of Kassaba	52.5	19.9	7.0	17.2	18.3	8.6	1.0	23.7	3.8	X	—	—	—	—	—	
62	Garawla	55.4	18.6	3.4	36.4	17.8	4.1	1.3	13.0	4.1	1.3	—	—	—	—	—	
63	Alam El Rum	36.3	8.6	23.3	7.6	55.3	1.7	X	1.7	X	—	—	—	—	—	—	
65	Mersa Matruh	59.1	13.2	17.1	18.4	48.7	1.3	—	—	—	—	1.3	—	—	—	—	
66	Lake Beach, Matruh	56.2	23.5	9.9	18.5	11.1	—	—	27.2	9.0	—	—	—	—	—	—	
70	Buqbuq, 43 Kms. East Of Saloum.	50.7	30.0	1.2	21.2	5.3	2.3	X	32.3	6.5	X	—	—	—	—	—	
71	32 Kms. East of Saloum	57.9	10.4	8.0	11.2	49.6	3.2	3.2	10.4	3.2	X	—	—	—	—	—	
	Average	49.5	22.1	8.5	15.7	34.0	2.0	1.0	12.5	3.5	X	X	—	—	—	—	
	FOURTH ZONE (SALOUM - BARDIA)																
72	5 Kms. East of Saloum	56.4	16.5	—	20.0	4.8	4.2	X	49.0	4.8	—	—	—	—	—	—	
73	In front of Halfaya-Saloum cemetry	65.9	14.4	—	18.0	12.6	2.7	6.3	41.4	3.6	—	—	—	—	—	—	
74	Bardia, Libya	58.0	32.4	5.3	18.9	12.8	2.2	1.5	25.5	X	—	—	—	—	—	—	
	Average	60.1	21.2	1.8	19.1	10.2	3.0	2.8	38.9	3.0	—	—	—	—	—	—	

x Less than 1%

* The iron ore frequencies were not taken in consideration when calculating the frequencies of other heavy minerals.

Fig. 1



MAP OF THE COAST BETWEEN ROSETTA & SALUM
SHOWING SAMPLING LOCALITIES
Kilom. 20 10 0 20 40 60 Kilom.
MEDITERRANEAN SEA
GULF OF SALUM
Bardia
Bay of Salum
Salum
Buqbuq
Sidi Barrani
EGYPTIAN LIBYAN FRONTIERS
Ras Um El Rakham
Mersa Matruh
Ras Alam El Rum
Matruh
Abu Hashaifa Bay
Hawala
Mersa Baqush
Ras El Kenayis
GULF OF KENAYIS
Ras El Daba
El Daba
Abu El Guruf Bay
Ras Gebeisa
Sidi Abd El Rahman
Alamein
ARABS GULF
El Omeiyid
Hammam
Burg El Arab
Dekheila
ALEXANDRIA
LAKE MARYUT
Abu Qir Bay
Abu Qir
LAKE IDKU
ROSETTA
RIVER NILE
25° 26° 27° 28° 29° 30°
31° 32°

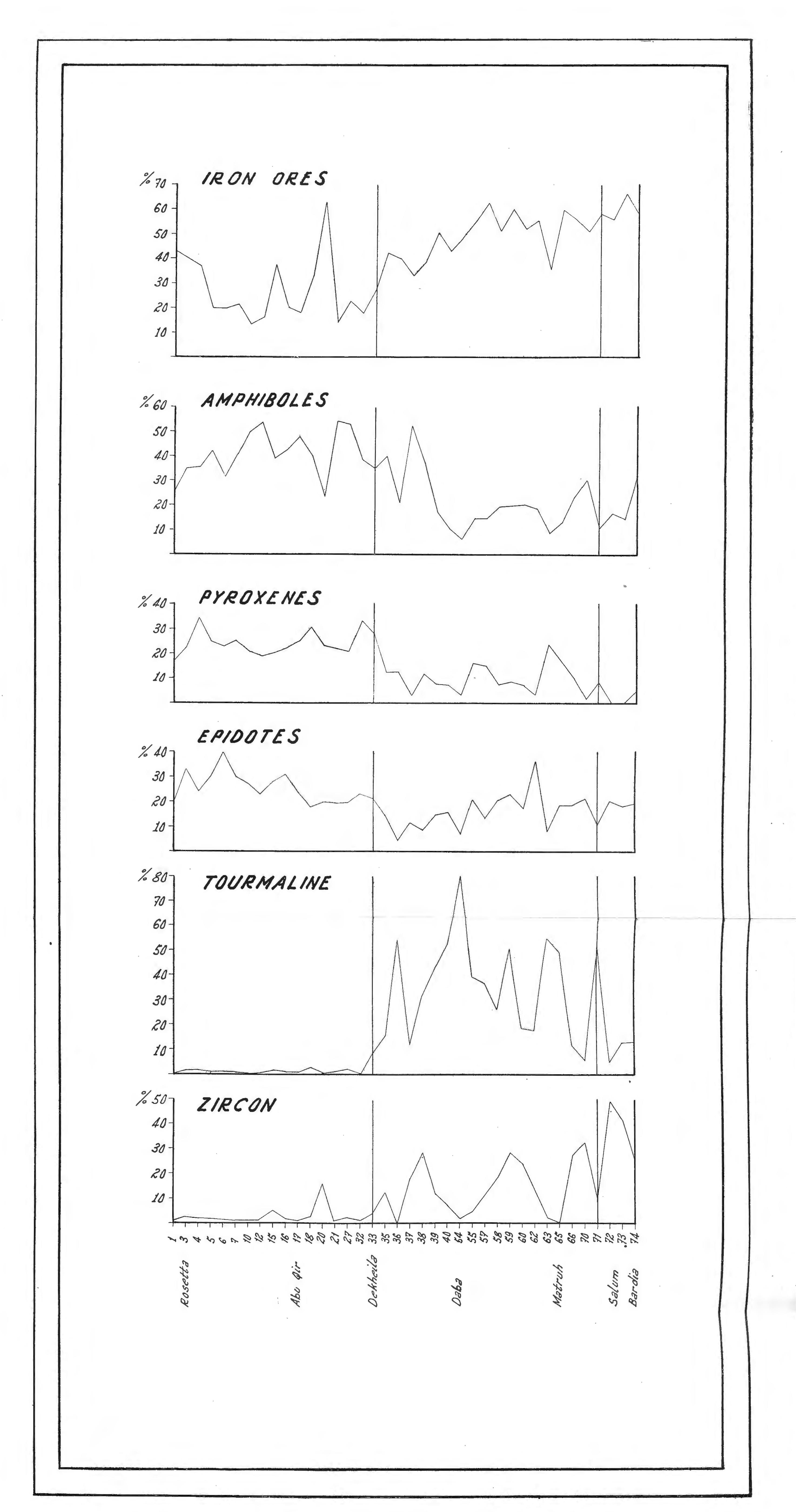


Fig. 2. — Relative Frequency of the main minerals recorded. Numbers refer to localities.
Iron ores were not taken in consideration when calculating the frequency of other minerals.

The Geology of the Mediterranean Coast between Rosetta and Bardia

Part II. Pleistocene Sediments : GEOMORPHOLOGY AND MICROFACIES

By

N.M. SHUKRI, G. PHILIP and R. SAID

I. INTRODUCTION

In part I of this work (Shukri and Philip, 1955) the mechanical analysis and mineral composition of the Recent beach sediments of the Mediterranean coast from the mouth of the River Nile at Rosetta, Egypt, to Bardia, Libya, were discussed.

The present work deals with the geology of some ridges and depressions present along the Mediterranean coast in the area between longitudes 25° 17′ E and 30° 4′ E and north of latitude 30° 35′. This work deals with the geomorphology of these ridges and depressions and their microfacies. The heavy mineral content of the Pleistocene Sediments will form the subject matter of part III. (Shukri and Philip, 1955).

Previous workers have expressed different opinions with regard to the mode of formation and environmental conditions of deposition of these ridges. Some authors consider them as being ancient sand dunes whereas others consider them as being marine in origin.

Fourtau (1893) identified four ridges in this Mediterranean coastal strip separated by three longitudinal valleys in between. This author mentioned that these ridges are formed of silicious limestone with a recrystallized top layer. In the valleys, Fourtau described a basal bed of clay that is sometimes overlain by alternate layers of gypsum and marl such as those in Wadi el Gyps. Fourtau ascribed a marine origin to the ridges and considered them to be derived from sediments that were cemented with a calcareous cement in a sea.

Blanckenhorn (1901 and 1921), described the area in a similar way and noted that the ridges are made of fossiliferous oolitic limestone with Foraminifera, pelecypods and gastropods. Blanckenhorn ascribed these ridges to a marine origin and considered them to represent bars cutting off lagoons in which gypsum was formed. He also noted that dune formations overlie unconformably the near-shore ridges.

Hume and Hughes (1921), in their work on the Maryut district, described the area as formed of four ridges (together with a ridgeless upland plain situated in the south) separated by four depressions. They described the most northern ridge as oolitic sand dunes which unite to form masses of more compact rock that shows local dips up to 18° having blown loose sand on top. Hume and Hughes ascribed a dune origin to the consolidated parts of the ridges and considered them to be formed by the prevailing north westerly winds. They mentioned that the blown particles were later hardened by the chemical action of rain water (op. cit. p. 4) and the help of capillary solutions (Hume, 1925, p. 57). Hume and Hughes (1921), considered the depressions to be due to subsidence.

Later Hume and Little (1928), also ascribed a dune origin to the ridges.

Andrew and Cuvillier (1938), ascribed a marine origin to a ridge 80 m. in height present to the south of the railway at Borg el Arab and forms the edge of the plateau to the south.

Ball (1939), also discussed the mode of formation of these oolitic ridges. From the configuration of the ridges, the absence of true bedding and the frequently very highly polished nature of the component grains, Ball concluded that these oolitic deposits have almost certainly originated from the consolidation of ancient littoral sand dunes. The base of the ooitic deposits was found in a boring 3 km. to the south east of Mersa Matruh at a level of 43 m. below the present sea level. He accordingly concluded that at the time of formation of these ridges a lowering in the sea level of at least 43 m. took place.

Sandford and Arkell (1939, p. 82) mentioned the presence of several alternating limestone ridges and hollows parallel to one another and to the Mediterranean shore line. They made a discussion regarding their riogin and concluded that the ridges afford a perplexing geological problem, but on the whole there is much to support the view that they were formed by wind action along a receding shore line. Sandford and Arkell gave interesting observations on the

material, shape and structure of the ridges. For instance they observed the similarity between the material of the Abu Sir ridge and the present day beach and the characteristic shape of the ridges with a steep landward slope and gentler seaward slope. Some of these observations will be discussed later.

Picard (1943), described them as calcareous sandstones similar to the Kurkar ridges of the Levant Coast of Palestine. The Kurkar is a calcareous sandstone derived from littoral as well as coastal dunes which was later hardened by calcareous solutions.

Schwegler (1948), similarly described the ridges as coastal dunes being the products of diagenesis of unconsolidated material which was later cemented by salts originally deposited on the surface by dew and spray and later carried into the ground by rain water.

Hilmy (1951), described the area and supported Ball's view as to the nonmarine origin of these ridges.

Zeuner (1952), described the ridges as stretches of consolidated coastal bars separating ancient lagoon floors. He identified a sequence of ten ancient bars which are given later.

Nevertheless two more recent authors attributed them to wind action. Paver (1954), considered the ridges to represent old dunes the material of which was derived from beach deposits.

Shata (1955), described the "most northern" ridge as an "embryonic" friable dune that represents the first stage in the evolution of these ridges. The third stage is a "mature" hardened ridge with a thick recrystallized top layer and a hard core.

The problem of age was also dealt with by most of the authors. Fourtau (1893), ascribed these ridges to a Pliocene age and considered them to have been derived from 'older Pliocene" sands. Blanckenhorn ascribes a Middle Pleistocene age for the lagoonal deposits in Wadi el Gyps. Ball (1939) assigned his ridges to a Late Sebilian age. Sandford and Arkell (1939), observed the absence of flint implements from the ridges or hollows. They assigned a post Middle Plaeolithic age to these ridges (p. 82), although they mentioned that the absence of the flint implements is not a conclusive evidence that the ridges are post Paleolithic (p. 78). They correlated the Mediterranean levels of Algieres as given by Deperet with the Nile terraces and compared the Tyrrhenian stage (30 — 35 m.) with the 30 m. Nile terrace containing Chellean implements and the Monasterian stage (18 - 20 m.) with the Acheulean 15 m. Nile terrace (p. 53). The higher group of 45 and 60 m. Nile terraces are to be correlated with the

Milazzian stage (55 - 60 m.) while the 90 and 115 m. Nile terraces are related to the Sicilian or oldest Pleistocene stage.

Andrew and Cuvillier (1938), ascribed an Oligocene age to a ridge 80. in height. They based their assumption on the presence of Lepidocyclines in addition to Nummulites and mentioned the presence of the following fauna in it :

Globigerina, *Triloculina*. *Pentallina*, *Textularia*, fragments of *Heterostegina* and *Operculina*, *Nummulites of* which some show the internal structure of *Nummulites intermidius* d'arch., an identifiable part of *Lepidocyclina* sp. together with debris of molluscs, echinoids, bryozoa and calcareous algea of the genus *Lithothamnion*.

Zeuner (1952, p. 233), mentioned that the ten bars range from Sicilian to Recent and was in favour of Sandford and Arkell's correlation of Nile terraces and Mediterranean levels.

Zeuner (op. cit.) gave the following ages for the ten bars present from north to south :

10. Harbour Island bar, sea level about the same as today, separated from it by a phase of low sea level (may correspond to the the first Interstadial of the Last Glaciation).
9. Gebel Abu Sir bar, sea level 5 — 10 m., Late Monasterian, second part of Last Interglacial.
8. Gebel Maryut bar, sea level 15 — 20 m., Main Monasterian, first part of Last Interglacial.
7. Sanakra Habub bar, sea level at 35 m., Tyrrhenian, Great Interglacial.
6. Ruweisat bar, sea level at 58 m., Milazzian, First Interglacial.
5. Gebel Bein Gaber bar, sea level at 80 m., Sicilian E.
4. Alam el Halfa bar, sea level at 80 — 100 m., Sicilian D.,
3. Mikherta bar, sea level at 85 m., Sicilian C.
2. Ragabet el Halif bar, sea level at 90 m., Sicilian B.
1. Alam Shaltut bar, sea level at 103 m., Sicilian A.

II. GEOMORPHOLOGY

In the present work the ridges are considered to represent bars or spits and the depressions separating the ridges to represent lagoons in which typical lagoonal deposits are present. Figure I is a sketch map of the area studied showing the position and extent of the ridges. Nine main bars are discerned in the present work ranging from Sicilian to pre-Roman. Table I gives a list of the different bars and

their correlation with the ridges described by previous workers and with Nile terraces. It is clear that in the main the same classification as that of Zeuner is adopted with a few discrepancies. The main difference lies in the fact that his bars No. 5 (Gebel Bein Gaber) and No 6 (Ruweisat) are considered as one bar, the KHASH EL EISH bar, owing to their continuity in the field, a fact which was further strengthened by the similarity of their microfacies.

Morphologically the bars have curved cross sections and show a gentle slope seawards and a steeper slope towards the land, characterestic of the sand bars. This curvature of cross section has been dealt with by Sandford and Arkell (1939, p. 79) who ascribed it to the effect of rain water. They suggested that water may have produced consolidation on an arched surface which, by subsequent denudation in a saturated medium may have produced this severe curvature. The ascribing of marine origin to these ridges would clearly solve the problem and account for the presence of the lagoons separating them. The presence of a conglomerate on top of the Milazzian bar in its northern side, near the lagoon separating it from the Tyrrhenian bar, the presence of several layers of gypsum in this lagoon, the continuity of the bars and their uniform elevation and direction for long distances are further evidences for the marine origin of the ridges. The aquous origin is strengthened by the presence of typical true oolites formed in situ and Pleistocene Foraminifera in them.

The Late Monasterian bar runs immediately parallel to the Mediterranean coast at some places extending from west of Alexandria to about 13 km. east of Saloum town, a distance of about 500 km. with nearly the same elevation throughout. The Main Monasterian bar which runs parallel to the previous bar southwards has the same extension westwards while it runs eastwards to Abu Qir town, about 17 km. east of Alexandria. The older bars that are present to the south begin west of Alexandria and extend till few kilometers east of Alamein, a distance of 110 kms. This may indicate that the recent configuration of the coast took place at least as early as the Main Monasterian time.

It is noticed that the elevations of the bars become some ten metres lower towards the Nile Delta (fig. I) and except for the Monasterian bars they actually die out to the east of Alexandria and may correspond probably to the limestones recorded below sea level in borings made at Kafr el Dawwar (Fourtau, 1915) and at other different localities in the Delta and in Alexandria city (Sandford

BARS DESCRIBED IN THE PRESENT WORK AND THEIR EQUIVALENTS IN PREVIOUS WORKS AND THEIR CORELATION WITH NILE TERRACES.

TABLE I

FOURTAU 1893	BLANCKENHORN 1901 & 1921	HUME and HUGHES 1921	SANFORD and ARKELL 1939	BALL 1939	ZEUNER 1952	PRESENT WORK	MCBURNEY and HEY 1955-CYRENAICAN PLATFORMS	NILE TERRACES
					Bar No. 10 Harbour Island Bar same as present sea level First Interstadial of Last Glaciation ?	Bar 0 Harbour Island Bar same as present sea level pre-Roman		3 meters Middle Mousterian
	Dune formations-Late Quaternary	Oolitic sand dunes	Recent Coastal dunes	Coastal dunes	Bar No. 8 Gebel Abu Sir Bar sea level 5-10m. Late Monasterian	Bar No. 1 Coastal Bar dominant level 10m. Late Monasterian	6 m.	9 meters Early Mousterian
Karm Sidi Kreir Pliocene	Gebel Sidi Kreir	Abu Sir-Dekheila ridge	Abu Sir ridge	First ridge Late Sebilian	Bar No. 8 Gebel Maryut Bar sea level 15-20m. Main Monasterian	Bar No. 2 Abu Sir Bar dominant level 25m. Main Monasterian	15 - 25 m.	9 meters Acheulean
Karm el Gattaf 1 or Gebel el Batn Pliocene	Gebel Maryut elevation 41 - 45 m.	Gebel Maryut-Gebel el Qarn duplicate ridge	Gebel Maryut ridge	Second ridge Late Sebilian	Bar No. 7 Sanakra Habbub Bar sea level 35m. Tyrrhenian	Bar No. 3 Gevel Maryut Bar dominant level 35m. Tyrrhenian	35 - 40 m.	30 meters Chellean
Karm el Gattaf 2 Pliocene	Gebel Nayil elevation 90m.	Upland Plain not ridge shape only in Maryut			Bar No. 6 Ruweisat Bar sea level 58m. Milazzian	Bar No. 4. Khashm el Kish Bar dominant level 60m. Milazzian	44 - 55 m.	45 meters
Karm el Gattaf 3 Pliocene					Bar No. 5 Gebel Bein Gaber Bar sea level 80m. Sicilian			60 meters
					Bar No. 4 Alam el Halfa Bar sea level 80m. Sicilian D	Bar No.5. Alam el Khadem Bar dominant level 80m. Sicilian D		90 meters
					Bar No. 3 Mikherta Bar sea level 85m. Sicilian C	Bar No. 6 Mikherta Bar dominant level 85m. Sicilian C	70 - 90 m.	
					Bar No. 2 Raqabet el Halif Bar sea level 90m. Sicilian B	Bar No. 7 Raqabet el Halif Bar dominant level 90m. Sicilian B		115 meters
				Third ridge ? Late Sebilian	Bar No. 1 Alam Shaltut Bar sea level 103 m. Sicilian A	Bar No. 8 Alam Shaltut Bar dominant level 110 m. Sicilian A	? 140 m.	

and Arkell, 1939 and Attia 1954). This lowering in the elevation of the ridges may be attributed to the bending under the load of the Delta sediments (Sandford and Arkell, 1939, p. 71) or to tectonic agencies. It is interesting to note that the difference in elevation (eastward inclination) at Alam Shaltut Bar is greatest (72 m) and is much less in the younger bars.

The Tyrrhenian and older bars also die out gradually few kilometers to the east of Alamein. There they merge into and aquire the elevation of the erosion surface present to the south and west of Alamein. This erosion surface that seems to be due to marine planation extends for a great distance and is seen as a completely levelled surface having a gentle slope to the north. It is cut in the ? Pliocene rocks and contains few littoral fossils and extends southwards into the Miocene rocks.

About 20 km. to the south west of Alamein, a number of elongated parallel depressions trending in general in an east-west direction are cut in the erosion surface (Fig. 5, pl. III). They are cut in the Pliocene as well as in the Miocene sediments to the south. The most pronounced and largest of these is the Qattara depression in the south. North of it is found a series of four parallel depressions that are some ten metres lower than the level of the surface. They reach two kilometers in width and are of variable length. These depressions are most probably water cut. They have an outlet and are not completely surrounded by cliffs. Wind, on the other hand, may have played a big role in carrying the loose sediments away.

The lagoons between the bars are of varying width. On the whole the lower more recent lagoons are filled with seeping sea water such as the lagoon between the Late and Main Monasterian bars in Alamein (Fig. 3, pl, II), Sidi Abd el Rahman and Mersa Matruh or with brackish water as the lagoon between the Main Monasterian and Tyrrhenian bars in its eastern end (Mallahet Maryut), while soil is occasionally present in these two lagoons at different places. The older lagoons are higher and are filled either with a clay soil that is suitable for cultivation, or with quartz sand grains as in the lagoons between the Sicilian bars at their western end.

Artificial clay banks 2 to 3 metres in height were built by the Romans in the cultivated lagoons around large areas of land to help the accumulation of rain water in these parts in the season of barley cultivation. These banks are circular, quadrant or horse shoe in shape and are still used by the inhabitants for the same purpose. These

were observed by Hume and Hughes (1921), who named them "Karm" after the Arabic name. These mounds or Karms are mostly present in the Maryut province in the lagoon between the Tyrrhenian and Milazzian bars.

Roman water cisterns are also present in the area. A huge cistern is dug in the Tyrrhenian bar at Burg el Arab, where rain water accumulates in it for use in time of dryness.

Other Ptolemaic and Roman remains are also seen in the area, where an old Ptolemaic temple is present on the Main Monasterian bar few hundred metres west of the Roman Abu Sir lighthouse (Fig. 4, pl. II). Another temple is found in Abu Mena in the lagoon south of the Sicilian Alam el Khadem bar. It is interesting to note that the bases of the columns of this temple are made of Numulitic limestone. The columns are made of the Italian Carrara marble. The walls of the temple are built of limestone blocks quarried from the nearby ridge. These show the extent of wind erosion since that time.

Secondary and transverse bars occur in some of the lagoons between the main bars specially the post Main Monasterian lagoon separating the Main Monasterian and the Tyrrhenian bars and the post Tyrrhenian lagoon separating the Tyrrhenian and Milazzian bars near their eastern extensions. The secondary bars are nearly parallel to the main bars and are found in the lagoons as isolated patches although they reach few hundred metres in length and are usually few metres higher than the level of the lagoon. These bars may change their direction as to become nearly transverse to the main bars. This change in direction is, however, gradual specially near the main bars and is probably due to a change in the direction of the currents.

Figure 2 gives north-south cross sections in different localities in the coastal area arranged from east to west together with a conventionalized general section, that is wholey hypothetical. On the other hand figures 3 to 7 give the distribution of the different lagoons of the different ages as deduced from the distribution of the present ridges and depressions.

In the following paragraphs, short notes on the different sand bars are given, beginning with the most Recent :

BAR O: HARBOUR ISLAND BAR :

This bar corresponds to Zeuner's bar No. 10 of the same name. It is present in the form of a shore platform that is seen in different

places on the shore specially in Alexandria city and westwards. It is not continuous for long distances but is seen as isolated parts. Shore platforms of this type were described by Hills, (1949). The sea level indicated by the bar is the same as that of today but seems to be separated from it by a phase of low sea level. This bar is dated as pre-Roman. Indications of a rising sea level in post-Roman times is evident every-where. Fishermen's villages that lie on the sea coast are today partially submerged. In Ras Hawala, the rock cut platform that was inhabited by villagers of the Roman period is covered by *Balanus* sp. and other marine encrusting invertebrates thus indicating its submergence in pre- Roman time. Slabs from this rock were cut by the Romans for their building purposes leaving behind perfectly smooth surfaces which were not encrusted by marine invertebrates, although there is a sure indication from the position of the village site that a slight rise in level occurred. The cutting of this stone by the Romans would also suggest that Strabo's statement (as quoted by Sandford and Arkell, 1939, p. 81) that Abu Sir lay exactly on the sea rather than being separated by the coastal bar is probably an inaccurate observation. Evidence of a post-Roman rise in sea level is also attested by the presence of Roman antiquities submerged below the sea level in Alexandria and the nearby places.

BAR I: COASTAL BAR :

This bar has an elevation of 10 m. above the present sea level. It is made of slightly consolidated false bedded calcareous oolitic sand. It extends fairly continuously with more or less the same elevation along the shore in western Egypt from Alexandria city to about 13 km. east of Saloum town, a distance of about 500 km. It is only missing in few localities (eg. at a locality 176 km. west of Alexandria where wave action has gone far as to level the area to a wave cut platform and to straighten its edge into a cliff). In many places this bar is acted upon by waves as to separate parts of it into sea stacks, these are best developed in Mersa Matruh and west of it.

The coastal bar seems to have the same elevation as Zeuner's Abu Sir bar No. 9. Since the Abu Sir temple and lighthouse do not lie on this bar, but lie on the next bar to the south, the name "Abu Sir" is given to the next bar.

The coastal bar is poor in Foraminifera and contains only few species that resemble the modern fauna of the Mediterranean (Said and Kamel, 1955). This bar is to be correlated with the Late Monasterian of the Western Mediterranean on the basis of its elevation.

Sandford and Arkell (1939, p. 79) believed that, at least in the area studied, this bar is in reality a ridge of coastal dunes that are in places still active. These authors have noted that these ridges are partially consolidated with drifted sand on their top. In the writer's opinion, however, this bar represents an older deposit which is, in places, covered by Recent drifted sand. This bar is continuous for a long distance and has the form and curvature of the older bars to the south. The drifting Recent sand lies unconformably above the consolidated bar in patches of white sand that contrasts with the darker light brown compact base. This bar is not to be confused with some of the recent hummocky exposures of drifting sand over a few localities to the north of this bar as in Agamy (Alexandria) or in Matruh.

BAR II: ABU SIR BAR :

This bar has an elevation of 25 m. above the present sea level. It is made of white oolitic limestone which makes it an excellent quarrying site specially for Alexandria city where it is quarried at Mex. This bar runs parallel to and has the same extent as the coastal bar westwards although it is present as far as Abu Qir town, 17 km. east of Alexandria. This bar corresponds to Sandford and Arkell's Abu Sir ridge, to Hume and Hughe's Abu Sir-Dekheila ridge, to Fourtau's Gebel Sidi Kherer and may correspond to Zeuner's Gebel Maryut bar on basis of elevation. The old Roman lighthouse and the Ptolemaic temple of Abu Sir lie on the top of this bar. The bar is separated from the coastal bar by a lagoon of varying width that is filled with a brownish soil. The lagoon is cultivated west of Alexandria nearly to Hammam town where the underground water level is easy to reach and varies from two to four metres according to the elevation of the lagoon. West of Hammam town, the post Late Monasterian lagoon becomes marshy and small recent lakes are found as in Alamein and Sidi Abd el Rahman. Near Mersa Matruh ordinary rock salt is quarried from such a lake. The Alexandria — Matruh highway passes through this lagoon and in many places runs on the Abu Sir ridge itself.

This bar has the same fauna as the coastal bar. It is dated as Main Monasterian on the basis of its elevation. It is to be noted that the two Monasterian bars are parallel to the Recent shore line which gives an indication that the present day configuration of the shore line took place at least as early as the Monasterian period.

BAR III : GEBEL MARYUT BAR :

This bar lies next to Abu Sir bar to the south and is separated from it by the post Main Monasterian lagoon that is now filled with brackish water seeping from the Delta. Thc eastern end of the lagoon is called Lake Maryut and is below sea level. The bar has an elevation of 35 m. above sea level and corresponds to Sandford and Arkell's and to Hume and Hughes's Gebel Maryut ridge. It may also correspond to Zeuner's Sanakra — Habub bar No. 7 or to Fourtau's Gebel el Gattaf, Gebel el Batn or Gebel Maryut ridge. The bar is made of a white oolitic limestone with a recrystallized darker brownish top. It is quite continuous without interruption with nearly the same elevation for a distance of about 110 km., extending from west of Lake Maryut to few kilometers east of Alamein where it dies out. In some places the ridge is cut by consequent streams.

Zeuner named his bar after two tribes that live around the Alexandria area. These names may be placed at different points on the map according to the edition used. The authors have not been able to locate exactly Zeuner's bar, but assume that he used a recent English edition of the map and think that his type locality may lie exactly to the south of Lake Maryut. If this is correct, then this locality would fit with Gebel Maryut in elevation, extent and morphological features. Furthermore, the microfacies and mineral composition of the sediments south of Lake Maryut and of those of Gebel Maryut are quite the same. This bar having an elevation of 35 m., correlates well with Deperet's elevation for the Tyrrhenian. This bar is the richest in organic remains. They are represented by Mediterranean Foraminifera with certain few Atlantic and Indo Pacific species. Calcareous algae, pelecypod and gastropod shell fragments and echinoid spines are also present in a large quantity. Secondary bars of the same age are seen in the lagoon between the Abu Sir and Gebel Maryut bars. These are contemporaneous with the latter as they possess the same microfacies and mineral constituents. King and Williams (1949), from observations on the nowadays

forming sand bars in Algieres, found that the seaward bar of the forming series (not more than four) is usually destroyed by surf waves during storms. The present authors believe that the secondary bars in the area studied originated in a similar way as they possess the same age as the main bars to the south on the basis of their microfacies and heavy mineral content. The secondary bars are especially found in the eastern part of the lagoon. They are few metres above its level and are found in isolated parts. Usually one secondary bar is present, while in some places in the older lagoons, as in the post Tyrrhenian lagoon, two secondary bars are present.

It is also interesting to notice that the Lake Maryut has two arm like extensions in its western side. The northern arm is in continuation with the post Main Monasterian lagoon while the southern arm is continuous with the post Tyrrhenian lagoon. This may indicate that Lake Maryut has a composite history and that its southern part was formed in pre-Main Monasterian time while its northern part is post Main Monasterian in age.

BAR IV : KHASHM EL EISH BAR :

This bar includes both Zeuner's bars, Ruweisat No. 6 and Gebel Bein Gaber No. 5. These two bars are morphologically indistinct and have the same microfacies and mineral contents. They are also continuous except for cuts of consequent streams and extend from west of Lake Maryut to few kilometers east of Alamein and hence are considered as one bar. Khashm el Eish bar has an elevation that ranges from 50 m. in the east to 90 m. in the west with a dominant elevation of about 60 m. and is thus given a Milazzian age. The eastward change in elevation from the Milazzian level is gradual and can be attributed to the bending under the load of the Delta sediments as previously mentioned. The westward change in elevation may be due to accumulation of wind borne material at the highest points. The importance of this factor at such points is still under investigation. The bar is made of oolitic hard limestone with a recrystallized brownish top layer. It contains a flood of Indo Pacific species of Foraminifera which contrast with the Foraminifera of the previous bars. In the separating lagoon to the north (the post Tyrrhenian lagoon) two secondary bars are present. In the main they are parallel to the main bar, while in some places they change their direction and become more or less perpendicular to the direction of the main bar. These

bars are present in the eastern part. On top of the main bar northwards, a band of rich fossiliferous limestone is present. The layer is specially rich in megascopic pelecypods. *Cardium edule* and *Perinella* sp. with some broken shells constitute the fauna of the bed.

In the post Tyrrhenian lagoon, near Hammam town, in a quarry for gypsum, a succession of alternate layers of gypsum and clay overlie unconformably the top of the Milazzian bar. In the section one can identify seven beds of gypsum alternating with seven beds of clay, indicating seven periods of aridity and seven periods of wetness in between as described in another publication (Said, Philip and Shukri 1956).

BAR V : ALAM EL KHADEM BAR :

This bar has a dominant elevation of 80 m. although it reaches 130 m. in certain places. It coincides with Zeuner's Alam el Halfa bar No. 4. It has an elevation that compares with the western Mediterranean Sicilian. The bar runs fairly parallel to the Milazzian bar except for its eastern extent which is present as isolated patches of rock having the same trend of the main bar. This bar is made of a hard limestone which is brownish in colour on top due to recrystallization. Crystallization has gone so far as to leave only small unaltered parts of the rock thus imparting to it a conglomeratic appearance. The dark brownish recrystallized parts contrast well with the fresh sediment. This bar as well as the older Sicilian bars contain *Operculinoides venosa*, which is definitely an Indo Pacific species, denoting a connection between the Mediterranean and Red Sea in the time of formation of these bars (see fig. 10). The lagoon separating this bar from the Milazzian bar is filled with a calcareous clay soil that is suitable for cultivation. Few karms are present in the eastern side of the lagoon, these are few in number compared with those in the Maryut province.

BAR VI : EL MIKHERTA BAR : 85 m.

BAR VII : RAQABET EL HALIF BAR : 90 m.

BAR VIII : ALAM SHALTUT BAR : 110 m.

These bars coincide exactly with Zeuner's bars No. 3, 2 and 1 that carry the same names. These bars are of Sicilian age. The eastern

ends near the Delta are some ten metres lower than the main elevation due to the effect of the weight of the Delta sediments as previously mentioned. The bars are made of oolitic limestone with a recrystallized top layer covering the fresh sediment and giving the bars a brownish colour.

The Mikherta bar is not continuous for a long distance compared with the previous bars since its eastern end begins at a locality nearly south of Burg el Arab, about 50 km. west of Alexandria and extends for about 45 km. in a south western direction. The Raqabet el Halif bar VII has nearly the same extension but has its eastern end some kilometers to the east of bar VI. The post Sicilian lagoon south of the Sicilian bar V, Alam el Khadem is accordingly very wide in its eastern side and is actually separating bars V and VIII.

Alam Shaltut bar VIII is continuous for a longer distance and extends from south of Alexandria city to a locality south of el Hammam town, a distance of about 80 km. The eastern side of the lagoon is filled with a calcareous clay soil that is cultivated while the western extension is filled with drifting quartz sand and low bushes of *Thymelea* sp. (Arabic : *Mathnan*), and a concentration of *Helix desertorum* shells on them.

The presence of these bars (near shore sediments) gives evidence of the existence of the Delta at that time (see figs. 8 — 11) and that its size has increased but moderately since early Pleistocene times as suggested by Zeuner (1952, p. 233). This is contrary to Ball's view (1930, p. 52, fig. 5) of the presence of a comparatively very small Delta in early Pleistocene times. Ball came to this conclusion by drawing the coast line of the Mediterranean according to the present day land contours. He did not take into account the lowering of the Delta (previously mentioned as of the magnitude of 20 m.). Such lowering would shift the present day contours a distance of several tens of kilometers northwards.

The area between Mersa Matruh and Saloum shows wave cut platforms at different levels of which the following approximate levels are recognized : 200, 100, 25 and 7 meters. This is interesting as they correspond more or less with similar wave cut platforms at Cyrenaica (McBurney and Hey 1955) and to some of the different bars of the Western Desert studied in the present work.

III — MICROFACIES OF THE PLEISTOCENE SEDIMENTS

This chapter deals with the microfacies (Cuvillier, 1951) of the sand bars in the area studied. The study is based on 117 samples representing the Pleistocene sediments, of which 82 thin sections are studied in detail. Fig. 1 shows the sampling localities of the different samples.

It was found that the microfacies of the bars of different ages are distinct and that it is possible to differentiate between the different bars according to their sum of their lithic and faunal characterestics. The most important elements of the study are the Foraminifera and other skeletal (Illing, 1954) representatives as algae, gastropods, pelecypods, echinoid spines and annelid tubes, together with oolites, heavy minerals and other petrographic characters. Oolites furnish a good differentiating ground between the different bars. They also furnish a good evidence for the aquous origin of the sediments since most, if not all the geologists agree on the aquous origin of the oolites.

Different theories regarding the formation of oolites were given by the different authors. Calcium carbonate is supposed to have been first precipitated by the aid of calcareous algae (Rothpletz, 1892, Wethered, 1895 and Dangeard, 1936), denitrifying bacteria (Vaughan, 1910 and 1914) or by inorganic physico-chemical agents (Link, 1903).

Vaughan, (1910 and 1914) states that calcium carbonate is precipitated in a gelatinous form which changes to spherulitic grains of 4 to 6 microns. These grow in size by chemical agencies which cause the precipitation of calcium carbonate in concentric shells around a nucleus. Vaughan attributes all marine oolites to such a process.

Bucher, (1918) in his colloidal theory ascribes the formation of most if not all the oolites and spherulites to the transformation of one substance from an emulsoid to a solid state.

Bradley, (1929) dealing with the ferruginous oolites of the Green River of Wyoming and Colorado, believes that oolites grow in situ when their surrounding matrix is in a partly colloidal state and observes the assosiation of cross bedding with oolites.

Eardley, (1938) discussing the oolites of the Great Salt Lake, Utah, restricts the oolites to the strongly agitated waters near shore lines where they are subjected to an oscillatory movement on the ripple marked bottom.

Pettijohn, (1949) states that the difference between oolites and spherulites is that the latter grow in situ and may mutually interfere with one another if their centres of growth are closely packed. Oolites on the other hand grow freely in turbulant water and hence do not exhibit effects of mutual interference.

Illing, (1954) mentions that oolites are formed where the sediments are subjected to strong marine tidal currents in warm waters supersaturated with calcium carbonate. He finds no evidence for the responsibility of algae in oolite formation, and supports the classical theory given by Hatch, Rastall and Black (1938) which ascribes oolites to form around moving nuclei encased in concentric layers of calcium carbonate precipitated from saturated waters and that are drifted backwards and forwards over a shallow sea floor in the track of tidal currents.

Illing differentiates between true and superficial oolites : superficial oolites are formed of a few concentric layers of carbonate around a comparatively large nucleus, while true oolites have no nucleus or a very small one is present with a large number of concentric layers or "ooliths" around.

Hilmy, (1951) as far as the authors are aware is the only author who has described the carbonate sands in thin section. He describes the section as having the following characterestics :

The grains are mainly formed of cryptocrystalline calcium carbonate. They are highly polished, rather irregular in shape and tend to be ellipsoidal or rod like and are well rounded ranging from one half to one millimeter in diameter. A concentric structure is uncommon and no nuclei, in the real sense, are found and when a quartz fragment is met with, it is near the margin. Microfossils of Tertiary and Recent Gastropoda, Lamellibranchiata and Foraminifera are present and possess nearly the same size and polishing as the grains. Some of the grains have a cementing mosaic of fine grained secondary calcite around them.

Hilmy, in dealing with the origin of these carbonate sands, mentions that "little can be said about the genesis of the so called "oolites" through direct precipitation from sea water". He states that from the absence of these rounded carbonate sands in the beach east of Dekheila and from their occurrence to the west of Dekheila and their gradual change into fairly consolidated oolitic limestone ridges away from the sea water, from the pure calcium carbonate composition of the carbonate sands, the shape of the grains, the

TABLE II AVERAGE FREQUENCIES OF ELEMENTS USED IN EVALUATING THE MICROFACIES OF THE DIFFERENT BARS.

	Carbonate grains	Organic remains	Quartz and heavy minerals	Cement	Oolites	Foraminifera	Remarks
Coastal Bar (east of Dekheila)	41.2	1.5	21.0	36.3	few superficial	Mediterranean	Quartz and heavy minerals present.
Coastal Bar (west of Dekheila)	69.8	2.0	1.9	26.3	true + superficial	Mediterranean	
Abu Sir Bar (east of Dekheila)	44.5	1.0	13.4	41.1	superficial only	Mediterranean	Quartz and heavy minerals present
Abu Sir Bar (west of Dekheila)	61.0	1.8	0.0	37.2	Fewer true + superficial	Mediterranean	Recrystallized layer of carbonate only.
Gebel Maryut Bar	43.0	18.0	3.0	36.0	superficial only	Appearance of Atlantic and Operculinoides venosa + Mediterranean	Recrystallized layer with concentration of quartz and heavy mineral grains
Khashm el Eish Bar	49.9	13.1	3.1	34.0	superficial only	Abundance of Indo-Pacific forms + Mediterranean	Recrystallized layer with concentration of quartz grains
Sicilian Bars	49.1	11.7	6.2	33.0	superficial only	few Operculinoides venosa + Mediterranean	Recrystallized layer with concentration of quartz grains.

absence of nuclei in the so called oolites, and the rather rare concentric texture in the thin sections, the fairly uniform size of the carbonate grains, the presence of highly polished and well rounded Tertiary microfossils and the absence of macrofossils, Hilmy is inclined to believe that these carbonate sands are not true oolites but represent wind borne clastic carbonate sands and that they are not authigenic but are derived from the Cretaceous-Eocene limestone formations of the nearby Western Desert.

Hilmy then concludes that the so called oolites of the Egyptian Mediterranean beach do not show exact similarity in character and mode of origin to the true authigenic oolites. Because of this superficial similarity to the true oolites he proposed to call these highly polished and well rounded carbonate sands "pseudo-oolites".

In the present work it is found that these rounded carbonate grains represent true oolites having up to 42 concentric layers of carbonate (photo 5, Pl. III). Such oolites seem to favour their formation by the precipitation of calcium carbonate from saturinted waters around moving nuclei. These are recorded in the Monasterian bars with a majority of superficial oolites having two or three concentric layers of carbonate around a nucleus of calcite, cryptocrysttalline carbonate, quartz, foraminifera or shell fragment. The grains are usually very well rounded as beach material should be. They are spherical, ellipsoidal or rod shaped. The grains are cemented usually by calcite the amount of which increases by aging, the Late Monasterian bar west of Dekheila being the least cemented. The type of oolites present seems to favour their formation by the precipitation of calcium carbonate from saturated waters around moving nuclei.

These carbonate oolites are not completely absent to the east of Dekheila but are present in a small amount, specially few kilometers east of Dekheila in the beaches of Alexandria due to the masking effect of the Nile sediments which could be detected to the east of Dekheila and which increase eastward due to the long shore currents which hit the shore obliquely in a northwesterly direction and which carry the Nile sediments eastwards. The amount of the carbonate thus decreases greatly reaching 2.4% at Rosetta while in Dekheila and to the west the carbonate content ranges from 83.7% to 99.9% with an average of 96.7% (Hilmy, 1951, and Shukri and Philip, 1955). Moreover one would not expect oolites to form to the east of Dekheila where the clays and silts of the Nile would interfere in such a way as to lessen the concentration of the carbonate material in the sea water. Some of the limestone ridges (namely the Coastal and Abu Sir bars) are in fact present to the east of Dekheila and are seen on the shore as far as Abu Qir, about 30 kilometers east of Dekheila and are detected in borings in the Delta to the south-east of Dekheila in Kafr el Dawar, Kom Difshou and other different places (Fourtau 1915, and Attia 1954).

In the following paragraphs a description of the microfacies of the different bars studied is given and the main elements of microfacies are given in table II.

BAR I : LATE MONASTERIAN COASTAL BAR :

This bar skirts the entire present day coast from Alexandria to about 13 km. east of Saloum. It is made of white oolitic more or less friable limestone overlain unconformably by wind borne sand to the west of Dekheila. To the east of Dekheila the bar is made of a brownish coloured rock that shows no oolite form. The microfacies of the bar is different according to its locality to the west or east of Dekheila. This difference is also noticed in the heavy mineral content of the bars (Shukri and Philip 1955, Part III.).

To the west of Dekheila the rock is microscopically formed of poorly cemented carbonate grains that are well rounded, spherical, elipsoidal or rod-like in shape. The cement which forms about 26% of the rock (per area) is in the form of fine needle-like crystals of calcite widely spaced causing the friability of the rock. Carbonate grains form about 70% of the rock. They are mostly in the form of superficial oolites (Illing, 1954) together with true oolites (about 20%). The oolites are built of nuclei of cryptocrystalline calcium carbonate, organic debris or a quartz grain with concentric layers of carbonate. These layers amount to 42 in number in case of the true oolites (photo 5, plate III.) and are only two or three layers in case of the superficial oolites. Few spherulites of radially arranged carbonate fibres are present. The grains vary greatly in size with diameters ranging between 0.08 and 1.36 mm. but most of them fall in the range size 0.25 and 0.40 mm.

The rock is poor in organic remains which form about 2% of the rock. These remains are in the form of calcareous algae, Foraminifera, pelecypod and gastropod fragments, annelid tubes and echinoid spines. Algae are represented by calcareous types of the unsegmented Corallinaceae *Lithothamnion*, *Lithophyllum* and *Goniophyllum*. Foraminifera is represented by species of the genera *Rotalia* sp., *Quinqueloculina* sp., *Peneroplis* sp. and *Amphisorus* sp. Pelecypod shell fragments are abundant and few microscopic gastropod shells of no more than 2mm. in length are observed.

To the east of Dekheila the sediments of the bar are microscopically formed of poorly cemented carbonate grains that form about 41% of the rock (less than that west of Dekheila) represented by rounded carbonate grains some of which are superficial oolites, while true oolites are not met with. The grains are poorly cemented with calcite which is present in the form of minute crystals and form about 36% of the rock. Quartz and other heavy mineral grains are present and make about 21% of the rock, marking a big difference between the western extension of the bar to the west of Dekheila, where it amounts to about 2% only. Organic remains are fewer than in the western extension of the bar (1.5%) and are represented mostly by pelecypod and gastropod shell fragments and few Foraminifera and other organic remains present in the western extension of the bar.

BAR II : MAIN MONASTERIAN ABU SIR BAR :

The bar extends from Abu Qir, about 20 km. east of Alexandria to about 13 km. east of Saloum. To the west of Dekheila it is made of white oolitic limestone which is harder and more compact than that of the coastal bar. The cement is in the form of well developed calcite crystals that fill completely the interstitial spaces between the grains and makes about 37% of the rock. This rock makes therefore, an excellent building stone.

Organic remains are present in the same frequency as in the coastal bar and in nearly the same genera and varieties. Quartz is nearly completely absent being recorded in only one sample with a frequency of 0.3%. The oolites make only about 61% being less than in the coastal bar. True oolites are even fewer than in the coastal bar. Occasionally two or more superficial oolites assemble, to form one big oolite with few layers around (Fig. 8, pl. IV) Foraminiferal species may act as nuclei for the oolites. Grain size is more or less uniform ranging between 0.1 and 0.25 mm. although grains may be as small as 0.04mm. or as big as 1.02mm. in diameter. The average grain size is smaller than in the coastal bar.

The top of the bar is usually recrystallized due to the effect of rain water or humidity giving rise to a solid brownish layer of few millimeters in thickness. This recrystallized layer is well developed in the older bars where it is not restricted to the top but extends deep in the rock particularly around fissures and cracks. In this layer the carbonate grains and oolites loose their shape gradually and become smaller till they are obliterated. The carbonate material is redeposited in concentric compact layers in which the clay impurities get concentrated giving the rock its brownish appearance or it is deposited in the interstitial spaces as a cement or as a crack filling. This process goes on by time and is clearly seen in the older bars where the hard brown layer extends for a few metres below the surface.

To the east of Dekheila the bar is more friable than its western extension but is harder than that of the Coastal bar. At Abu Qir the true oolites are nearly absent and only a few superficial oolites are present. Here the cement is greater in amount than at the western extension and than that of the Coastal bar, it has an average of 41.1%. Quartz and heavy mineral grains are present having an average of 13.4% in contrast with the western extension where quartz is present in only one sample in a very low frequency (0.3%). Organic remains are represented by the same elements as the western extension of the bar but are still fewer, having an average of 1%.

BAR III : THE TYRRHENIAN GEBEL MARYUT BAR :

Gebel Maryut bar lies next to Abu Sir bar to the south and is separated from it by a lagoon that is now filled with brackish water at its eastern end : Lake Maryut. The top of the bar is recrystallized to a hard dark brownish limestone while the mass of the sediment is still unaltered as can be seen in cuts of the quarries in Burg el Arab where the rock is still an oolitic white slightly cemented limestone. The recrystallized layer is similar to that of the Main Monasterian bar but includes some heavy minerals of the insoluble silicates and quartz giving it the darker colour.

Carbonate grains are present as superficial oolites which are either yellowish in colour or are completely stained with red ochreous material. The oolites form about 43% of the rock. Quartz grains and heavy minerals as hornblende and augite are frequently met with and form about 3% of the sample. Glauconite is seen to replace some organic remains in few samples. Incidentally the presence of glauconite gives a further evidence as to the aquous origin of these sediments.

Gebel Maryut bar is the richest in organic remains; they form about 18% of the rock and are represented by calcareous algae, Foraminifera, pelecypod and gastropod fragments? annelid tubes and echinoid spines. Algae are represented as in the previous bars by *Lithothamnion*, *Lithophyllum* and *Goniophyllum*. Foraminifera are represented by a rather rich fauna that is distinct and contrasts with the fauna of the Monasterian bars and the recent shores. The foraminifera recorded here are the following : *Quinqueloculina agglutinans* d'Orbigny, *Spiroloculina excavata* d'Orbigny, *Nonion* sp., *Rotalia* sp., *Rosalina globularis* d'Orbigny, *R. vulvulata* (d'Orbigny), *Elphidium crispum* (Linné), *E. macellum* (Fichtel and Moll), *E. excavatum* (Terquem), *Amphisorus duplex* (Carpenter), *Operculinoides venosa* (Fichtel and Moll).

This fauna is mainly Mediterranean in aspect with some influx of Atlantic species. The fauna indicate a warm climate. The decidedly Pacific *Operculinoides venosa* specimens are so few that it may be possible that they owe their origin to derivation from the older bars that are richer in such forms or may be due to migration from the Red Sea through a connection between it and the Mediterranean Sea.

The micro-organisms, oolites and mineral grains are cemented together with calcite which is present in well developed crystals that completely fill the interstitial spaces and form about 36% of the rock.

The grains and oolites vary greatly in size ranging from 0.05 to 1.4 mm. in diameter although elongated grains as long as 2.21 mm. in length occur. A size of 0.4 to 0.6 mm. in diameter dominates and most of the grains are rounded, spherical or elipsoidal in shape.

BAR IV : THE MILAZZIAN KHASHM EL-EISH BAR :

This bar is separated from Gebel Maryut bar by an old lagoon that is now cultivated at several places. The bar is formed of a hard limestone bed that is recrystallized to a brownish massive layer at the top but traces of its oolitic structure in its deeper parts are seen. On the top of the bar near the separating lagoon to the north, a band of limestone, very rich in megascopic pelecypods is present (*Cardium edule* bed).

Oolites form about 50% of the rock and are represented by superficial oolites only, the majority of which are stained reddish by iron oxides. Quartz is present as rounded grains and form about 3% of the rock.

Organic remains form about 13% and are represented by calcareous algae of *Lithothamnion*, *Lithophyllum* and *Goniophyllum* species, Foraminifera, particularly representatives of the Miliolidae: *Triloculina affinis* d'Orbigny, *T. oblonga* (Montague), *Quinqueloculina bradyana* Cushman, *Q. undulata* d'Orbigny, *Q. seminulum* (Linné), *Spiroloculina depressa* d'Orbigny, *Textularia candeiana* d'Orbigny, *Elphidium* sp., *Rosalina globularis* d'Orbigny, *Marginulina* sp., *Operculinoides venosa* (Fichtel and Moll), *Amphistigina* sp., *Bigenerina* sp., *Marginopora* sp.,

Some of these forms are decidedly of Indo-Pacific aspect and must have invaded the Mediterranean from the Pacific through a connection that probably flooded the present Suez Isthmus (see fig. 9). Other organic remains as pelecypod and gastropod shells,? annelid tubes and echinoid spines are present.

The cement is made of calcite and forms about 34% of the rock. Well developed crystals of calcite are also found in veinlets in the recrystallized layer. Carbonate grains are in the form of spherical or elipsoidal superficial oolites that have a grain size that varies from 0.04 to 1.2 mm. with a dominant size ranging between 0.2 and 0.4 mm. The grains are very well rounded.

SICILIAN BARS :

BAR V : ALAM EL-KHADEM BAR :

BAR VI : EL-MIKHERTA BAR :

BAR VII : RAQABET EL-HALIF BAR :

BAR VIII : ALAM SHALTUT BAR :

The above mentioned four bars are quite similar with regards to their composition and their micro-organic content. They are considered as of Sicilian age and are made of a hard limestone bed weathering to a brownish colour. The same colour is seen along fissures where water was able to percolate. The recrystallization has gone so far as to leave only small unaltered parts of the rock, hence its conglomeratic appearance. This top recrystallized layer is deep due to the prolonged effect of recrystallization, however, the fresh sediment is oolitic in nature.

Oolites form about 49% of the rock and are represented by superficial ooliteso. Quartz is present in a higher frequency than in the preceding bars and amounts up to 8.5% with an average of about 6%. Quartz grains are large, well rounded, more or less spherical and have a dominant size of 0.8 mm. in diameter. Quartz gets concentrated in the recrystallized layer of the sediment where it is angular and much smaller in size (about 0.2 mm.) than in the fresh sediment.

Organic remains form about 12% of the rock and are represented by calcareous algae of the *Lithothamnion*, *Lithophyllum* and *Goniophyllum*. Foraminifera is represented by *Operculinoides venosa* (Fichtel and Moll), some representatives of the Miliolides as *Quinqueloculina* sp., *Spiroloculina* sp. Few specimens of *Peneroplis* sp., *Rotalia* sp., and *Elphidium* sp., are also present. Other organic remains are mainly pelecypod and gastropod fragments, echinoid spines and? annelid tubes. The Indo-Pacific forms present are not as abundant as those recorded in the previously described bar.

The cement is a well developed crystalline calcite which is often seen in cracks. Grains are usually smaller in size than in the previous bars with a size range between 0.02 and 0.7 mm. although few grains reach a diameter of 1.5 mm. The main dominant size ranges from 0.2 to 0.35 mm. represented by well rounded grains the majority of which are spherical or elipsoidal in shape.

It is noticed that the Tyrrhenian, Milazzian and Sicilian bars contain Indo-Pacific forms of Foraminifera that may indicate connections between the Mediterranean and the Red Sea at the time of formation of these bars. Such a connection is attributed to a high sea level in the interglacial periods when these bars are assumed to be formed. The maximum inundation seems to have been in the Milazzian where a large percentage of Indo-Pacific species are present contrary to the ideas commonly expressed as to the presence of a maximum connection in the Tyrrhenian (Huzayyin 1941). In fact the Tyrrhenian Pacific forms are so few as to make it possible that these forms may have been secondarily derived from the older bars. The Monasterian bars do not contain IndoPacific forms in any frequency as the relatively low sea level with respect to the land at that time, did not, apparently, permit a connection between the two seas.

Table II summarises the average frequencies of the different elements of microfacies. It is noticed that the petrographic characters of the various bars are different. The Late Monasterian bar, being the most recent of the bars studied, to the west of Dekheila is made of true and superficial oolites with a low percentage of cement while eastwards only superficial oolites are present with an abundance of quartz and heavy mineral grains. In the Main Monasterian bar, the true oolites are fewer and most of the carbonate grains are present as superficial oolites with an increase in the amount of cement. True oolites are not seen in the older bars and only superficial oolites are present. The brownish recrystallized top layer is seen to appear in the Main Monasterian bar and gets thicker in the older bars. In the Tyrrhenian bar this layer contains a concentration of quartz and heavy mineral grains, while in the Milazzian and Sicilian bars this layer contains a concentration of quartz only. Crystallization is seen in its different stages where the fresh sediment is found at a distance below the ground with gradations till the completely recrystallized top layer towards the surface is reached. Recrystallization starts in the top layer and around cracks where the oolites get smaller in size and the amount of cement increases till the oolites are completely obliterated. The non-soluble materials as clays and heavy minerals get concentrated in this outer layer rendering its brownish colour. Cracks in this outer layer are seen to be filled with secondary calcite in colourless crystals that are apparently formed after it.

It is noticed that the secondary and transverse bars present in the lagoons north of the main Tyrrhenian and Milazzian bars contain the same elements of microfacies and the same species of Foraminifera comparable to the main bars to the south. This fact in addition to the similarity of their heavy mineral content in varieties and frequencies with the main bar strengthens the conclusion as to their contemporanity as previously mentioned.

The presence of Mediterranean Foraminifera in the Monasterian bars gives no indication that a warmer climate prevailed as stated by Huzayyin (1941) but shows a similar climate to that of the present day. The Tyrrhenian, having mainly a Mediterranean fauna with the presence of few Indo-Pacific species, that may be residual from the Milazzian fauna, may indicate a similar climate or at most a slightly warmer climate. The fauna of the Milazzian which is mainly Indo-Pacific shows the warmest climate. The Sicilian fauna is characterized by the presence of an appreciable amount of Indo-Pacific species but in smaller frequencies than in the Milazzian. This indicates a warm climate during the Sicilian though it is colder than the Milazzian climate. The attribution of a warm climate to the Sicilian contrasts with the opinion given by both Deperet (1918) and Huzayyin (1941).

IVI. — SUMMARY AND CONCLUSIONS :

The present work deals with the geology of the Pleistocene sediments of the Mediterranean coast west of Abu Qir town. These are present in the form of sand bars separated from each other by lagoons. It deals with their geomorphology, and microfacies.

Nine main bars are discerned. They are separated by seven lagoons. The bars are dated from pre-Roman to Sicilian according to their elevation as follows :

1. — Bar O, Harbour Island Bar, pre-Roman, same sea level as the present day, but seems to be separated from it by a phase of low sea level.
2. — Bar I, Coastal Bar, Late Monasterian, 10 m.
3. — Bar II, Abu Sir Bar, Main Monasterian, 25 m.
4. — Bar III, Gebel Maryut Bar, Tyrrhenian, 35 m.
5. — Bar IV, Khashm el Eish Bar, Milazzian, 60 m.
6. — Bar V Alam el Khadem Bar, Sicilian D, 80 m.
7. — Bar VI, El Mikherta Bar, Sicilian C, 85 m.
8. — Bar VII, Raqabet el Halif Bar, Sicilian B, 90 m.
9. — Bar VIII Alam Shaltut Bar, Sicilian A, 110 m.

The ridges are considered as marine bars or spits because of their extension, uniform direction and elevation (except in certain parts), their curved cross section with gentler slopes towards the sea, the presence of a conglomerate on top of the Milazzian bar, the presence of Pleistocene Foraminifera in them and of lagoonal deposits in the depressions separating the ridges.

The bars are lower in elevation in their eastern ends. This lowering in elevation is attributed to compaction of the Delta sediments (Sandford and Arkell, 1939). The bars in certain places are much higher than the dominant levels. This is the case with the Milazzian and the Sicilian Alam el Khadem bars where they are some 30 metres higher than the general levels. This may be attributed to the deposition of aeolian deposits during or after the emergence of these older bars. The presence of these bars shows also that the Delta was in existence as early as the Sicilian time and that its size increased but moderately since the early Pleistocene times (Zeuner, 1952).

The Monasterian bars skirt the coast from Abu Qir to about 13 km. east of Saloum, a distance of about 500 km., while the older bars extend from west of Alexandria and die out few kilometers east of Alamein. This gives an indication that the configuration of the present day coast took place at least as early as Monasterian times.

The present Lake Maryut has two arm like extensions at its western side. The northern one coincides with the post Main Monasterian lagoon while the southern arm coincides with the post Tyrrhenian lagoon. This may show that the present day Lake Maryut has a composite history and that its southern part was formed at a different age from its northern part.

Secondary and transverse bars are present in the post Main Monasterian and the post Tyrrhenian lagoons. These bars are lower in elevation than the level of the corresponding main bars. The secondary bars are nearly parallel to the main bars. They owe their origin to surf waves whereby the northward bar of the series is acted upon by the waves and destroyed during storms. This is ascertained by the similarity of the microfacies and the heavy mineral contents of the secondary and main bars to the south of each set of them. Secondary bars may change their direction as to become nearly perpendicular to the main bars. This change is gradual and may be attributed to a change in the direction of currents.

The microfacies analyses of 82 thin sections showed that the Late Monasterian bar to the west of Dekheila is made of true and superficial oolites that are poorly cemented in calcite with few quartz and heavy mineral grains. Quartz and heavy minerals increase greatly

to the east of Dekheila. There the true oolites are not recorded and the superficial oolites are less in number and clay material is present. Organic remains are represented by Foraminifera that are similar to the present day Mediterranean species, shell fragments, algae, echinoid spines and annelid tubes. The Main Monasterian is similar in organic content to the previous bar but the oolites are fewer and the cement is better developed. True oolites are absent in the older sediments, the superficial oolites being the only ones present. The Tyrrhenian bar is the richest in organic remains and shows the presence of a few Indo-Pacific species in addition to those previously mentioned in the Monasterian bars. The Indo-Pacific forms are few as compared with those present in the Milazzian bar which is the richest in them. The Indo-Pacific species are also present in the Sicilian bars. The forms present in the Tyrrhenian bar are so few that they can be regarded as derived from the older sediments. The presence of these forms in the Sicilian and Milazzian bars can be attributed to connections between the Mediterranean and the Red Sea at these times. This shows also that the climate was warmer than at present. This attribution of a warm climate to the Sicilian contrasts with the opinion given by Huzayyin (1941).

The top of the Main Monasterian and older bars shows a sign of recryatallization which gets thicker with the increase of age of the sediment. In the Tyrrhenian bar this layer contains a concentration of quartz and heavy minerals while in the older sediments only quartz grains are seen.

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Fig. 1. — 10 m. coastal bar, 32 kms. east of Saloum.

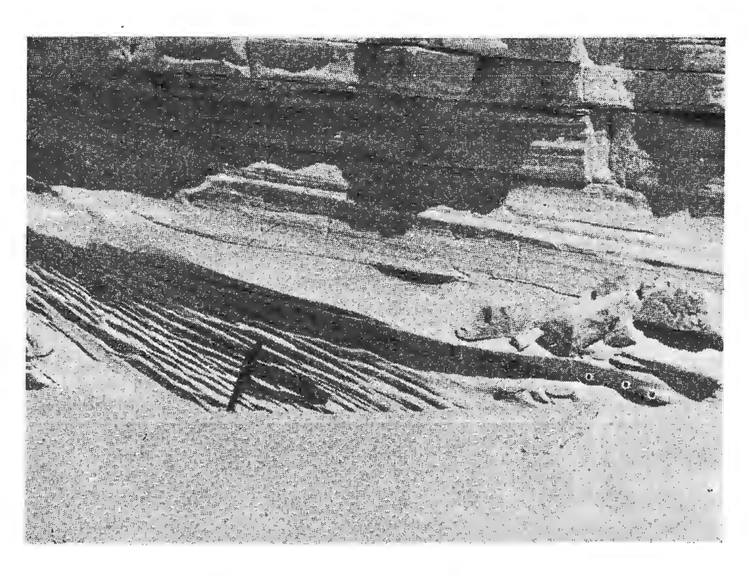


Fig. 2. — Current bedding in the 10m. coastal bar, 5 kms. west of Matruh City, looking south.

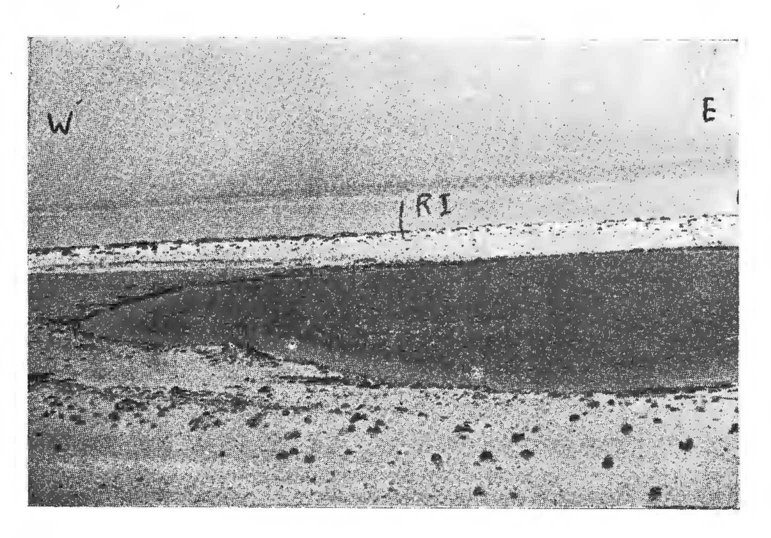


Fig. 3 — Showing the Coastal bar (R1) with the post-Late Monasterian lagoon separating it from the Abu Sir bar, filled with seeping sea water at Alamein. The Mediterranean Sea is in the background.

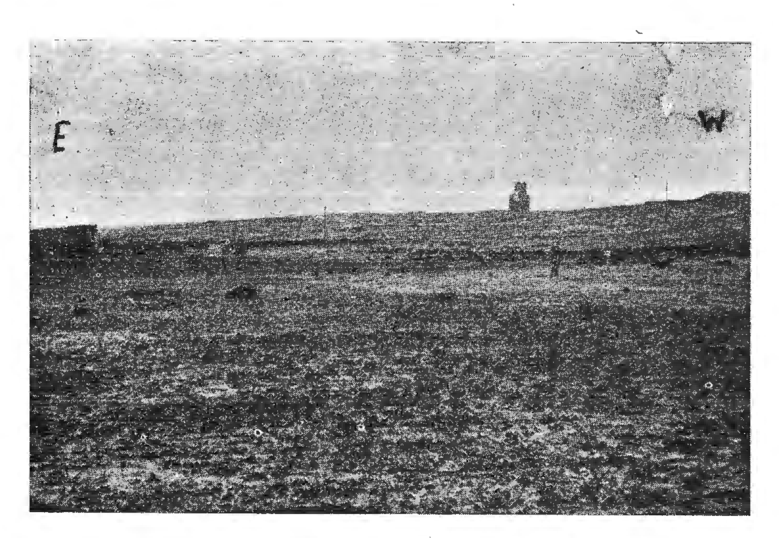


Fig. 4. — Showing the Abu Sir bar and the old Roman lighthouse on top. Post Late Monasterian lagoon is in the foreground, photo looking south.

PLATE III



Fig. 5. — Showing Deir el Abiad, a small depression south of Alamein and its northern (N) and southern (S) boundaries.



Fig. 6. — Top of Khashm el Eish bar showing differential erosion.

PLATE IV

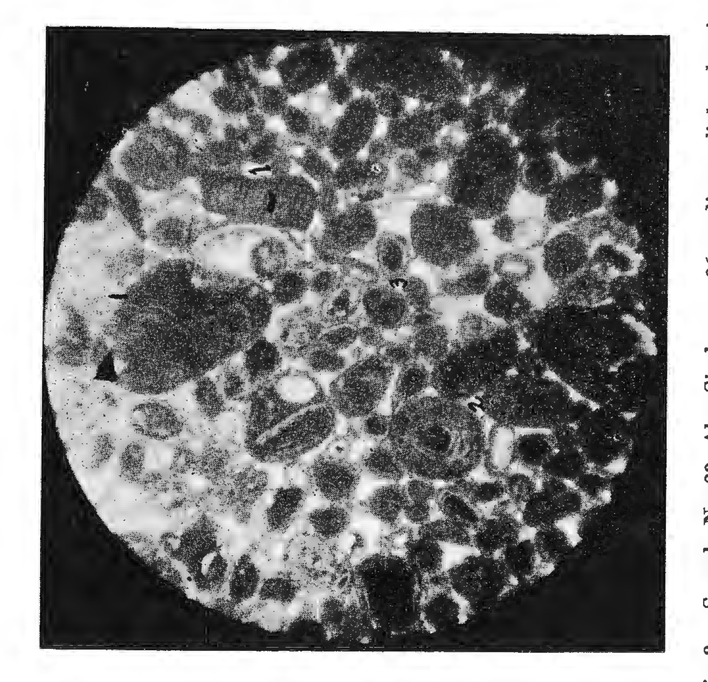


Fig. 8.—Sample No. 23, AbouSir bar, x 36, ordinary light showing.
1— Calcareous algae.
2— True oolites.
3— Superficial oolites.



Fig. 7. — True oolites, sample 1, Coastal bar x 60 ordinary light.

PLATE V

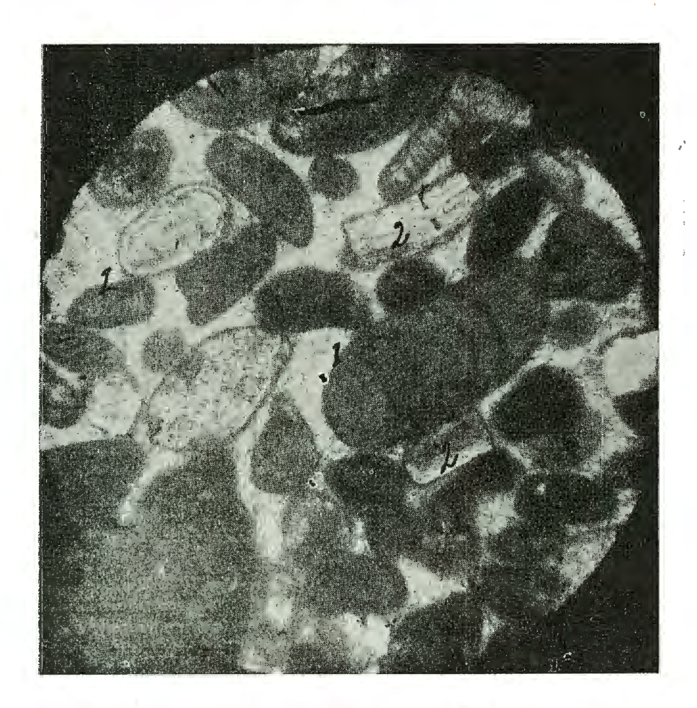


Fig. 9. — Sample No. 58, Khashm el Eish bar, Milazzian, x 80, ordinary light showing.
1— Calcareous algae.
2— Shell fragment and superficial oolites cemented in calcite.

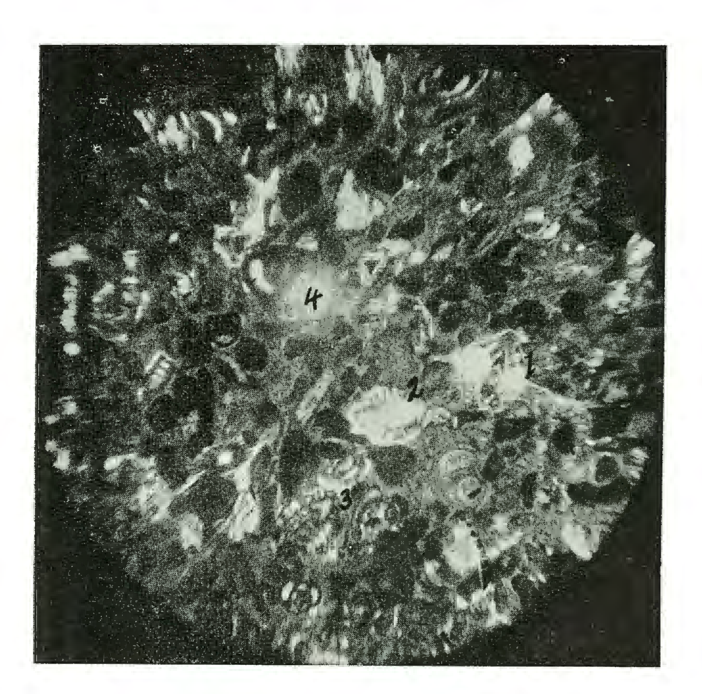


Fig. 10. — Sample No. 64, Khashm el Eish bar, Milazzian, x 36, ordinary light, showing.
1, 2 and 3— Different sections in *Operculinoides venosa* (Fichtel and Moll).
4— A Section in *Triloculina* sp.

PLATE VI

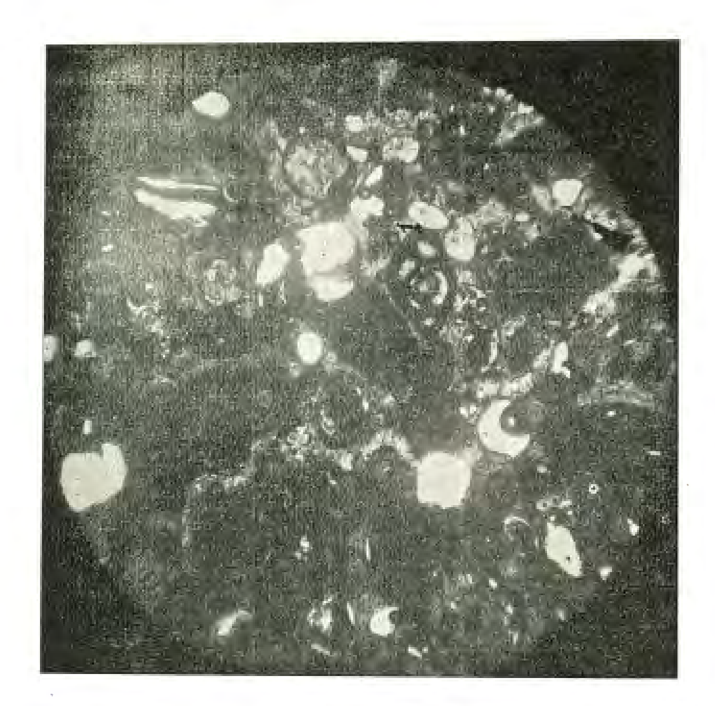


Fig. 11.— Sample No. 76, Alam el Khadem Sicilian bar, x 36, ordinary light, showing.
1— A section in *Quinqueloculina* sp. and superficial oolites cemented with calcite.

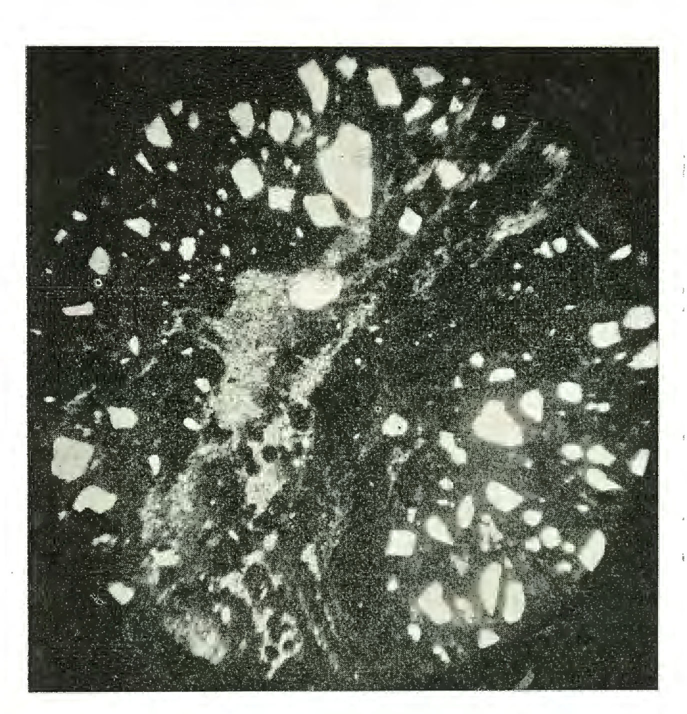


Fig. 12.— Sample No. 87, Alam Shaltut Sicilian bar, x 25, ordinary light showing a section in the recrystallized zone with a concentration of quartz grains.

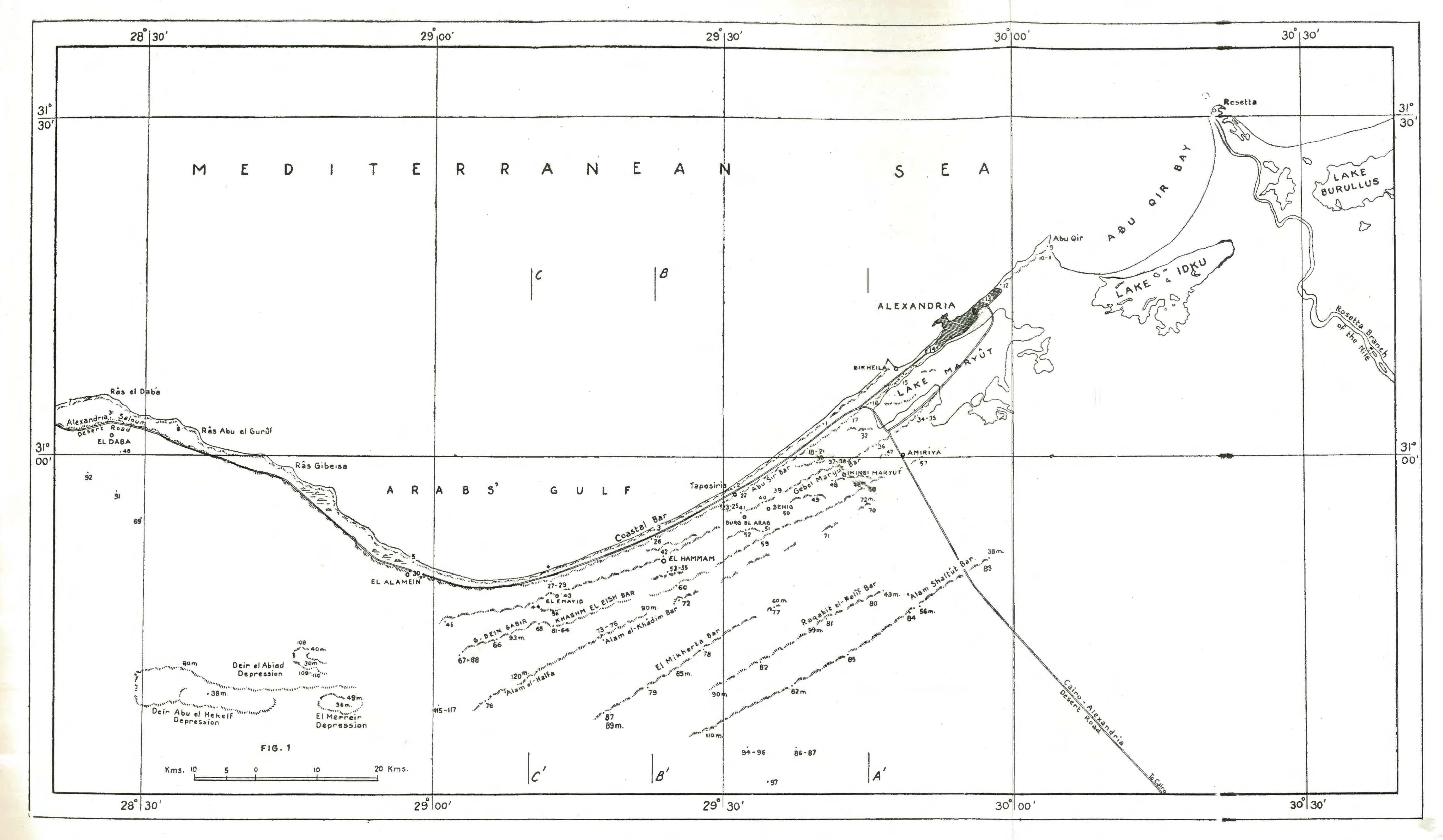


Fig. 1.— Sketch map of the area studied showing the position and extent of the bars and the sampling localities.

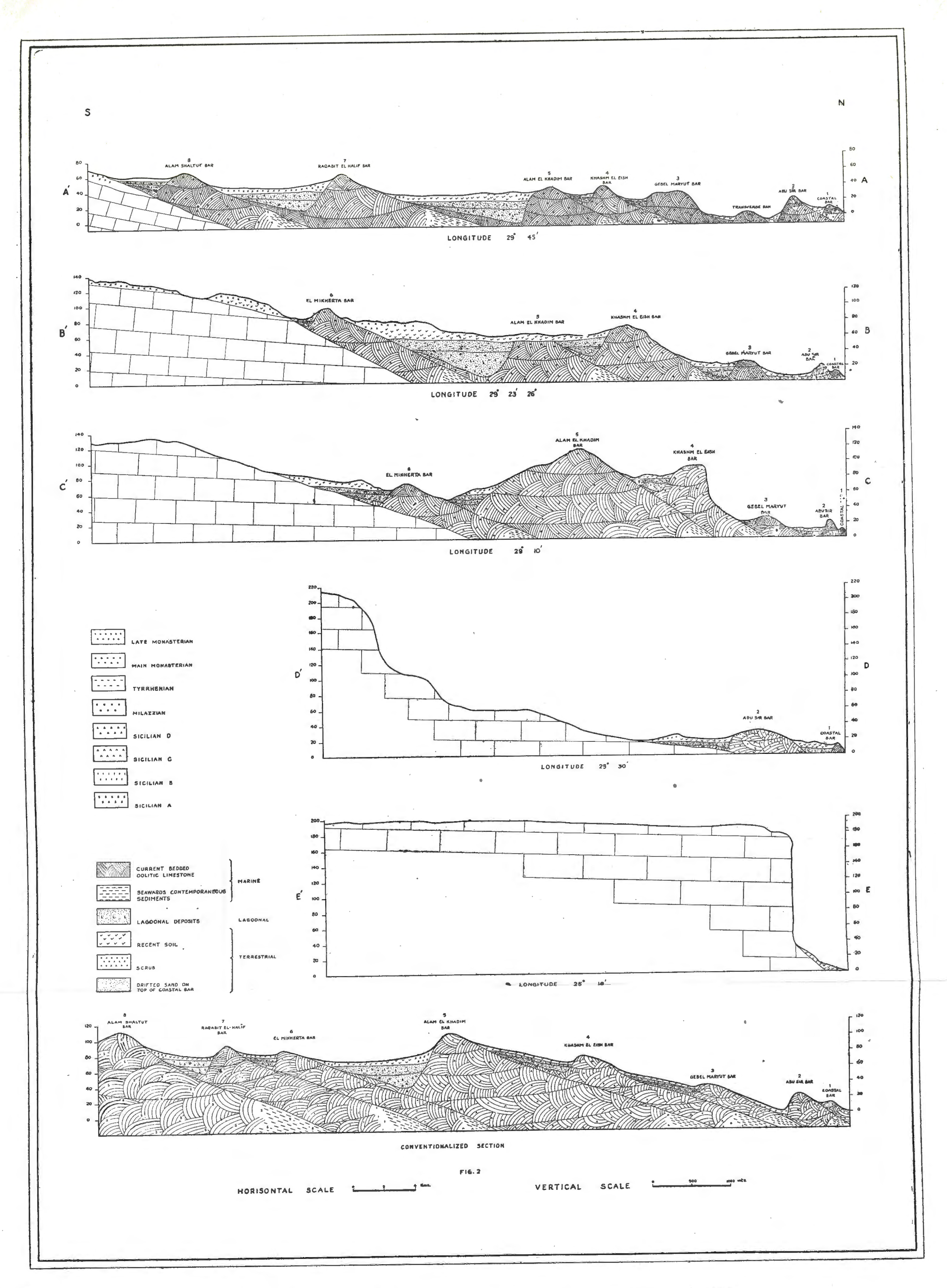


Fig. 2.— A-E : Hypothetical north-south cross sections along different localities and diagramatic conventionalized cross section.

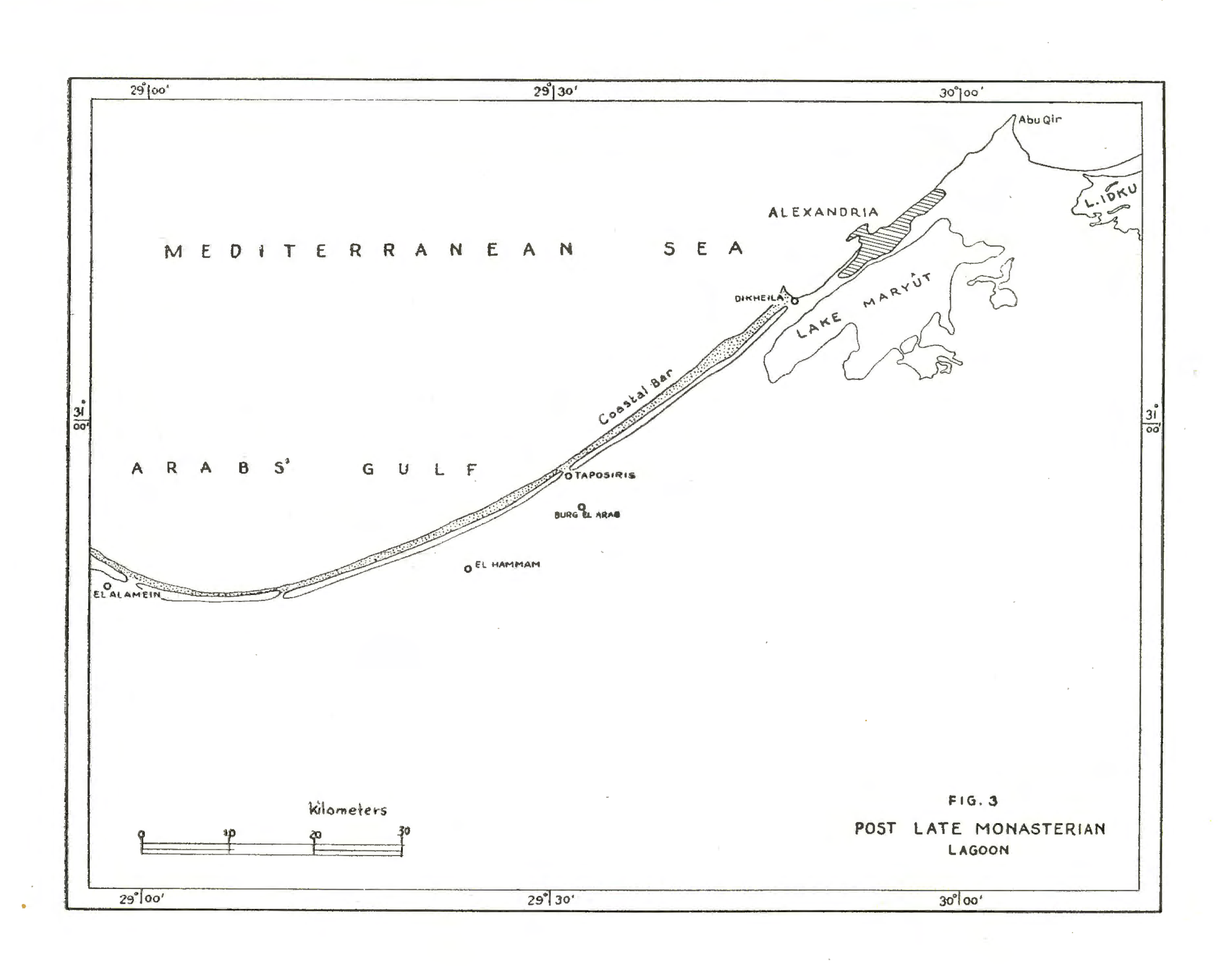


FIG. 3
POST LATE MONASTERIAN
LAGOON

29°00' 29°30' 30°00'

Abu Qir

ALEXANDRIA

L. IDKU

MEDITERRANEAN SEA

DIKHEILA

LAKE MARYÛT

Abu Sir Bar

Secondary Tyrrhenian Bars

31° 00'

ARABS' GULF

TAPOSIRIS

BURG EL ARAB

EL HAMMAM

EL ALAMEIN

kilometers

0 10 20 30

FIG. 4

POST MAIN MONASTERIAN LAGOON

29°00' 29°30' 30°00'

29°00' 29°30' 30°00'

Abu Qir

ALEXANDRIA

L. IDKU

MEDITERRANEAN SEA

DIKHEILA

LAKE MARYÛT

Secondary Milazzian Bars

Gebel Maryut Bar

31° 00'

ARABS' GULF

EL ALAMEIN

kilometers

0 10 20 30

FIG. 5

POST TYRRHENIAN LAGOON

29°00' 29°30' 30°00'

29°00' 29°30' 30°00'

Abu Qir

L. IDKU

ALEXANDRIA

MEDITERRANEAN SEA

DIKHEILA

LAKE MARYÛT

31° 00'

ARABS' GULF

BURG EL ARAB

EL HAMMAM

Milazzian

Khashm el Eish Bar

EL ALAMEIN

kilometers

0 10 20 30

FIG. 6

POST MILAZZIAN
LAGOON

29°00' 29°30' 30°00'

29°00' 29°30' 30°00'

Abu Qir

L. IDKU

ALEXANDRIA

MEDITERRANEAN SEA

DIKHEILA

LAKE MARYÛT

31° 00'

ARABS' GULF

'Alam el Khâdim Bar "D"

BURG EL ARAB

El Mikherta Bar "C"

Raqabit el Halif Bar "B"

'Alam Shaltût Bar "A"

EL HAMMAM

EL ALAMEIN

kilometers

0 10 20 30

FIG. 7

POST SICILIAN
LAGOONS

29°00' 29°30' 30°00'

MEDITERRANEAN SEA

CAIRO

GULF OF SUEZ

GULF OF AQABA

RED SEA

0 50 100 kilometers

FIG. 8

MAIN MONASTERIAN SHORE LINE

MEDITERRANEAN SEA

CAIRO

GULF OF SUEZ

GULF OF AQABA

RED SEA

0 50 100 kilometers

FIG. 9

TYRRHENIAN SHORE LINE

MEDITERRANEAN SEA
CAIRO
GULF OF SUEZ
GULF OF AQABA
RED SEA
0 50 100 kilometers

FIG. 10
MILAZZIAN SHORE LINE

MEDITERRANEAN SEA
CAIRO
GULF OF SUEZ
GULF OF AQABA
RED SEA
0 50 100 kilometers

FIG. 11
SICILIAN SHORE LINE

The Geology of the Mediterranean Coast Between Rosetta and Bardia

PART III : PLEISTOCENE SEDIMENTS : MINERAL ANALYSIS

by

N.M. SHUKRI and G. PHILIP

MINERAL ANALYSIS

In Part I of this work (Shukri and Philip, 1955), the heavy mineral content of the present day beach sediments were examined. The study showed that the present day sediments are different along the coast extending from Rosetta to Saloum and were divided into four different zones; the first zone between Rosetta and Abu Qir and the second between Abu Qir and Dekheila contained mineral grains that are characteristic for the present day Nile sediments, whereas the recent sediments farther west are devoid of such varieties.

In part II, the geomorphology and microfacies of some Pleistocene sand bars ranging from Sicilian to Late Monasterian were dealt with. The present work deals with the mineralogy of these bars and is an attempt to detect any change in their mineralogy. It also attempts to correlate these bars with the alluvial terraces of the Nile.

The present work is based on 105 samples of which 75 were quantitatively examined.

Technique used in laboratory :

The sediments being limestones were treated with dilute acetic acid to obtain the mineral fraction to be examined. A known weight of the sample was dissolved in acetic acid 1:8 on a water bath to enhance the reaction. The sample was occasionally washed to remove the calcium acetate film which retards the reaction. When all the

carbonate is dissolved, the residue is dried, weighed and the carbonate percentage calculated. This residue was then separated in bromoform (sp. g. 2.85) to separate thc heavy fraction. The heavy minerals were weighed to calculate the index figures. A representative sample of both the heavy and light fractions was then mounted in canada balsam for microscopic examination. More than 300 grains in random fielis were counted in each sample and the relative frequencies of the different minerals were calculated. Iron ores were found to constitute a large portion of most of the samples and were not taken in consideration when calculating the frequencies of the other heavy minerals. The frequency of iron ores relative to the heavy minerals of the sediments are also given.

Petrography :

The results of the mineral analyses are given in table I arranged more or less according to their decreasing order of abundance. Table II gives the range and average of the different bars together with the recent beach sands in the two petrographic zones for comparison. The samples analysed are arranged first according to their age and then each age (bar) when containing characteristic minerals similar to the recent sediments of the Nile, is subdivided into two zones : an eastern (first zone) containing such minerals and a western (second zone) devoid of Nile minerals. The percentage of some of the important minerals is graphically given in figure 1.

The index figures of the bars are on the whole very low and are markedly low when there is no contamination from the Nile minerals. There is thus a difference amongst the index figures of the two zones of a single bars. The index figures of the first zone of the second bar, for instance, range between 0.31 and 1.45 with an average of 0.46 whereas they range between 0.01 and 0.43 with with an average of 0.07 in the second zone of the same bar. On the whole the index figures range between 0.01 and 1.45, the second zone of the first bar being the poorest in heavy minerals. The index figures of the Sicilian bars are the highest compared with the second zones of the other bars.

The carbonate content is high in all the bars ranging between 43.6 and 99.9%. On the whole the average carbonate content for all the bars is over 90% except in the Sicilian bars where it is a little

less. This is believed to be due to the higher content in quartz owing to the dissolution of the carbonate material by the prolonged effect of rain water and dew leaving the quartz grains concentrated in the top layers of the bars. This may account for the decrease in the carbonate percentage of the top layers of the oldest Sicilian 110 m. bar as compared with the youngest Sicilian 80 m. bar. The second zone of the first bar which is the poorest in heavy minerals is the richest in carbonate content.

In the following paragraphs a concise description of the detrital minerals recorded and their distribution is given :

MINERALS OF THE LIGHT FRACTION :

In the first zone where the Nile minerals dominate, quatrz, orthoclase, microcline, plagioclase feldspars and muscovite constitute the minerals of the light fraction. In the second zone, quartz is the dominant mineral of the light fraction in addition to a very small percentage of feldspars which is not present in all the samples.

Quartz is present in angular to subrounded grains in the first zone with a size ranging from 0.04 to 0.65 mm. in diameter. In the second zone it has a narrower range of rounding, being better rounded and is present in relatively larger sizes reaching up to 0.96 mm. Rare grains as small as 0.04 mm. are however, present. Feldspars occur in small prismatic grains having an average of 0.42 mm. in length and 0.12 mm. in width. Muscovite is present in ragged flakes and is confined to the samples east of Dekhiela of the post Sicilian bars. The provenance of the muscovite seems to be the Nile sediments.

MINERALS OF THE HEAVY FRACTION :

Minerals of the heavy fraction will be discussed in the same order given in table I.

IRON ORES :

Iron ores are present in all the samples in a high frequency that reaches 86.4% in sample 19 of the Abu Sir bar. Iron ores are represented by magnetite, ilmenite and haematite. Magnetite and ilmenite are the most abundant while haematite is present in few samples and in small frequencies. Ilmenite is seen to occur in fresh grains which are sometimes partially or completely altered to leucoxene. Iron ores in general are small in size ranging from 0.04 to 0.16 mm. in diameter. They occur in subangular to subrounded

grains of no definite shape, while some grains are well preserved and show the crystallographic faces in magnetite.

Iron ores do not show a regular difference in frequency between the different bars or between the two zones of the same bar. They have a maximum average frequency in the Sicilian Mikherta bar reaching 65.6% and a lowest average of 31.5% in the first zone of the Tyrrhenian Gebel Maryut bar.

AMPHIBOLES :

Amphiboles are represented by different varieties of hornblende, some members of the fibrous tremolite-actinolite series, glaucophane and riebekite. Hornblende is present in all the samples while the fibrous amphiboles and riebekite are confined to samples of the first zones only. Glaucophane, on the other hand, is present in random samples in the first and second zones. Hornblende is represented by five varieties :

1. — A dark brownish green pleochroic variety.
2. — A dark bottle green nonpleochroic variety.
3. — A rare brown hornblende.
4. — A light bluish green pleochroic variety.
5. — A light brownish grass green pleochroic variety.

In the first zone the first four varieties of hornblende are recorded in addition to members of the tremolite-actinolite series and glaucophane. Two varieties of hornblende are the most abundant, namely a dark brownish green and a dark bottle green varieties which are identical to the Nile varieties.

In the second zone, however, amphiboles are mostly represented by the bluish green, the light brownish grass green and the brown variety that were subordinate in the first zone together with few glaucophane grains in some places.

Hornblende occurs in stout fresh prismatic grains that are larger in the first zone ranging from 0.14 to 0.52 mm. in length and from 0.06 to 0.23 mm. in width.

The frequency of amphiboles is different in the different bars and is not the same in the two zones of the same bar. The first zone has usually a markedly higher amphibole content than the second. The average content of the Main Monasterian, the Tyrrhenian and the Milazzian bars is 38.9, 47.8 and 34.6% respectively for the first zone, while it is 20.1, 25.0 and 25.0% for the same bars in the second zone.

PYROXENES :

Pyroxenes are represented by members of both the monoclinic and the rhombic series occuring in subangular to subrounded grains ranging from 0.14 to 0.62 mm. in diameter. The monoclinic series is the most abundant and is represented by augite of different varieties, aegirine and diopside. The rhombic members are enstatite and hypersthene which are, together with aegirine, confined to the first zone.

In the first zone augite is found in two main varieties : a violet brown faintly pleochroic variety and a pale greenish yellow variety that are identical with varieties recorded in the Nile sediments. The violet brown augite is most abundant in the eastern end of the first zone, while the yellowish variety being more flakey is seen farther to the west. The presence of these two varieties in the first zone gives uncontestable evidence as to the effect of Nile sediments on the heavy mineral content of the bars in this zone. Diopside is also present in the first zone. Of the rhombic pyroxenes, hypersthene is more abundant than enstatite although both are rare.

In the second zone, pyroxenes are represented by two varieties of augite that are different from those present in the first zone namely a light green variety and a dark olive green one. Few grains of diopside are also recorded in some samples. This shows two different sources for the material of the first and second zones namely from the Nile sediments on one hand and probably the older sediments in the west on the other.

The two zones are further distinguished on the basis of the frequency of the pyroxenes. The first zone in the Main Monasterian bar has an average of 17.5% while the second zone of the same bar is comparatively very poor having an average of 2.0%. The same applies to the Tyrrhenian and Milazzian bars in which the first zone has an average of 17.3 and 12.3 whereas the second zone has an average of 3.3 and 4.2% respectively. Meanwhile the pyroxene in the first zone decreases westward, for instance, in the Main Monasterian Abu Sir bar, it decreases from 17.9% at Abu Qir in the east to 4.6% at Dekheila showing that the Nile sediments decrease westwards. This is attributed to the north easterly long shore currents which carry the Nile sediments eastwards.

It is also interesting to notice that though the two Nile varieties of augite disappear near Dekheila in the Main Monasterian bar (this is also true for the Late Monasterian bar as shown by a qualitative examination of its heavy minerals), the two varieties do not

disappear in the Tyrrhenian bar except as far west as Behig, some 40 km. west of Dekheila and in the Milazzian bar at about 35 km. west of Dekheila. This shows that though the currents are similar in Monasterian times to those at present, it must have changed in strength or direction during Tyrrhenian and Milazzian times. The Nile sediments are present in post Sicilian bars and are completely absent in the Sicilian bars even to the east of Dekheila. This gives a dating of the pouring for the first time of the waters of the Abyssinian tributaries of the Nile into the Mediterranean.

It is also to be noticed that the relative frequencies of the Nile (Abyssinian) varieties of augite in the Milazzian are smaller as compared with those of the Tyrrhenian and the Monasterian bars. On the other hand Shukri and Azer (1952) noticed that the frequency of augite in the Chellean 30 m. Nile terrace, which corresponds to the Tyrrhenian on basis of elevation, was already smaller than in the younger terraces. The significance of this discrepancy between the Mediterranean bars and the Nile terraces is at present under investigation.

It is also interesting to notice that the pyroxenes and other heavy minerals in the transverse bars north of the Tyrrhenian and Milazzian bars are similar to those of the corresponding main bars. For instance the transverse bars north of the Tyrrhenian main bar contain yellowish augite and other Nile varieties in quantities comparable with the main Tyrrhenian bar to the south. Again the transverse bars north of the main Milazzian bar contain the same varieties in comparable frequencies. This shows that the secondary bars are contemporaneous with the corresponding main bars to their south and confirms the conclusion arrived at using the geomorphological evidence

EPIDOTES :

Epidotes are represented by pistachite, zoisite and clinozoisite. Pistachite is the most dominant variety. It is present mostly in subrounded or rounded grains that have a wide range in size from 0.05 to 0.44 mm. in diameter. Zoisite and clinozoisite have a smaller size range. Except for the Coastal bar, which is the poorest in epidotes, they are present in all the samples with a little difference in frequency and in nearly the same varieties, thus they are not to be taken in consideration in the differentiation between the different bars or between the two zones of the same bar.

TOURMALINE :

Except for the Coastal bar tourmaline is poorly represented in the different bars and in the two zones of the same bar. It is present in two distinct types that can be used in differentiating the two zones of the same bar. In the first zone a rounded variety of different colours is recorded. It is found in red, grey, blue, black and brownish varieties that are usually small in size, having a diameter ranging between 0.14 and 0.26 mm. In the second zone, few grains of the previously mentioned varieties are recorded in addition to the variety characteristic for the second zone. This is a prismatic idiomorphic variety. It is strongly pleochroic from bluish green to intense golden or brownish yellow. Usually magnetite or needle like rutile inclusions are found inside these grains. This variety is usually large in size, reaching a length of 1.50 mm. and a width of 0.68 mm., although a dominant size is 0.81 mm. in length and 0.28 mm. in width. It is interesting to notice that this variety is present in the sand dunes at Sidi Bishr, Alexandria and seems to have its origin in the sediments to the west and was brought by the north westerly winds. The Coastal bar is characterized by the abundance of tourmaline in the second zone, where it is the most frequent mineral after iron ores. It varies from 23.8 to 48.5% with an average of 33.5%. In the other bars tourmaline has a small frequency and is not recorded in all the samples. Its average ranges from 0.71 in the first zone of the Tyrrhenian bar to 2.1% for the second zone of the same bar.

GARNET :

Garnet is represented by two varieties, a pink dominant variety and a colourless rarer one. The colourless variety is only present in samples of the eastern end of the first zone. Garnet has nearly the same frequency for all the bars and for the two zones of the same bar. Its average ranges between 1.3% in the first zone of the Tyrrhenian bar and 3.3% in the first zone of the Main Monasterian bar.

STAUROLITE :

The mineral is represented by a golden yellow pleochroic variety that is mostly present as stout prizmatic grains ranging from 0.12 to 0.27 mm. in width and from 0.28 to 0.61 mm. in length. Staurolite is recorded from all the bars but is not recorded in all the samples. It has a random frequency and shows no difference between the two zones. Its average ranges from 0.6% in the second zone of the Tyrrhenian bar and 2.3% in the Sicilian Raqabet el Halif bar.

ZIRCON :

Zircon is represented by small prismatic grains most of which are of the colourless variety although few yellow grains are recorded. It usually occurs in the form of small prisms with subrounded edges, but idiomorphic bipyramidal and broken crystals are also present. The grains range in size from 0.04 to 0.28 mm. in length, while in the second zone they do not reach a large size. Zircon is found in the same varieties in the first and second zones but in different frequencies. In the first zone it is found in a smaller frequency with averages of 11.0, 6.6 and 17.8% for the Main Monasterian, the Tyrrhenian and the Milazzian bars respectively. In the second zone, these frequencies increase to 29.3, 28.7 and 26.6% for the three bars respectively.

RUTILE :

Rutile is represented by a reddish brown and a yellowish brown varieties. It is usually found as minute prisms with almost rounded ends ranging from 0.04 to 0.14 mm. in length. Few grains in the first zone exceed this size. The mineral is present in all the samples and is a good differentiating factor between the first and second zones where it is found in higher frequencies in the second zone. Rutile has an average frequency of 3.2, 2.2 and 4.8% in the first zone for the Main Monasterian, the Tyrrhenian and the Milazzian bars respectively, while the averages for the same bars in the second zone are 6.2, 9.6 and 8.5%.

KYANITE :

Kyanite is represented by long prismatic colourless grains having two cleavages at right angles and is recorded in all the bars. It is found as few grains in the sample with a size ranging between 0.14 and 0.39 mm. in length. It is usually found in small frequencies with a maximum of 3.3% in a sample from the Sicilian Alam Shaltut bar although the mineral is not recorded in all samples.

BIOTITE :

Biotite is represented by a brown variety in the form of cleavage flakes. The flakes are large reaching up to about 2 mm. in length in some samples. The mineral is not recorded in many samples but is present in all the bars. It reaches its maximum frequency in a sample from el Mex in the first zone of the Abu Sir bar.

TITANITE :

The mineral is present in all the bars in frequencies that never

exceed 1%. It is represented by a brown subangular variety with grains that range in size from 0.16 to 0.34 mm. in diameter.

APATITE :

Apatite occurs in small rounded colourless grains that are present in few samples only in the first zone of all the bars. It is usually less than 1% in frequency except in one sample where it is 1.0%. Apatite is present in the Recent Nile sediments and thus gives an indication as to the source of the minerals of the first zones of the bars.

MONAZITE :

The mineral is recorded in one sample in the first zone of the Abu Sir, Main Monasterian bar. Being a Nile mineral that is granular and not easily carried by sea water is confined to the eastern end of the zone whereby it is recorded only in Abu Qir.

SILLIMANITE :

The mineral is recorded in many samples in all the bars except in the Coastal and some of the Sicilian bars but in low frequencies that do not exceed 1% except in few samples reaching a maximum of 2.0% in sample 75 of Alam el Khadem Sicilian bar. It occurs in colourless long prismatic grains which occasionally possess irregular edges.

ANATASE :

Anatase is not present in all the samples examined. It is present in prismatic and irregular grains of blue and bluish green colours. The grains are usually large in size reaching a length of 0.65 mm. although much smaller grains are seen.

Anatase has a Higher frequency in the second zone where it is 10.1, 1.1. and 1.2% for the Main Monasterian, Tyrrhenian and Milazzian bars respectively, compared with 0.5, 0.1 and 0.3% for the same bars in the first zone. The Main Monasterian bar is the richest in anatase in its second zone as compared with the other bars. This enrichment of the anatase in the second bar seems to be due to local conditions which were probably the same cause for the enrichment of the tourmaline in the first bar.

SUMMARY AND CONCLUSIONS :

The heavy minerals of 75 specimens of the different bars were examined. It is shown that the Sicilian sediments are devoid of mi-

nerals characteristic for the Abyssinian tributaries of the Nile (Shukri 1950 and 1951 and Shukri and Azer, 1952). These Nile minerals were first present in the Milazzian Khashm el Eish bar. This fixes the age of the capturing of the Blue and Atbara waters as Milazzian in age. Shukri and Azer in a previous work (1952) considered the capturing to have taken place during the time of the formation of the 30 m. (Chellean) Nile terrace. The 45 and 60 metres Nile terraces corresponding to the Milazzian bar were not examined by them.

It was noticed that the relative frequencies of the Nile (Abyssinian) varieties of augite in the Milazzian were smaller as compared with those of the Tyrrhenian and the Monasterian bars. On the other hand Shukri and Azer (1952) noticed that the frequency of augite in the Chellean 30 m. Nile terrace, which corresponds to the Tyrrhenian on basis of elevation, was already smaller than in the younger terraces. The significance of this discrepancy between the Mediterranean bars and the Nile terraces is at present under investigation

The study shows that the Nile sediments are recorded in the Monasterian bars westwards only till Dekheila corresponding in this respect with the recent beach. This may show that the currents remained the same in direction and strength since that time. The study shows also that the Nile sediments in the Tyrrhenian and Milazzian bars are present some 35 - 40 kilometers farther west than in the Monasterian and recent beach sediments which may be attributed to a change in the strength or direction of sea currents.

It was found possible to differentiate between the Milazzian and Sicilian bars at their eastern ends by the fact that the Milazzian bar contains Nile sediments whereas the Sicilian bars are devoid of such material. Again it is possible to differentiate between the Milazzian bar and the more recent ones by its poverty in the Nile pyroxenes which gives a further evidence of differentiating it from them.

The similarity of heavy minerals in varieties and frequencies between the main bars and their corresponding secondary and transverse bars favours the assignment of the same age to them.

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Table I

RELATIVE FREQUENCIES OF HEAVY MINERALS OF SAMPLES OF PLEISTOCENE SAND BARS WEST OF ABU QIR

Samples arranged from east to west for each bar

No. of sample	LOCALITY	Iron Ores*	Amphiboles	Pyroxenes	Epidotes	Tourmaline	Garnet	Staurolite	Zircon	Rutile	Kyanite	Biotite	Titanite	Apatite	Monazite	Sillimanite	Anatase	Index Figure	Carbonate content
	COASTAL BAR LATE MONASTERIAN 10m. SECOND ZONE																		
1	El Deraa	48.4	13.8	1.7	14.4	40.5	1.2	X	21.4	2.3	X	X	—	—	—	—	2.9	0.01	99.9
2	Burg el Arab	46.6	16.5	4.6	11.6	29.1	1.9	—	29.1	3.9	—	2.9	—	—	—	—	—	0.10	99.4
3	El Hammam	52.6	9.0	2.6	12.2	29.6	3.2	X	33.0	5.2	—	X	—	—	—	—	—	0.02	99.9
4	El Emayid	47.1	11.4	9.0	12.6	48.5	1.2	1.8	12.6	3.0	—	X	—	—	—	—	—	0.02	99.9
5	El Alamein	55.3	16.6	1.3	8.7	34.0	1.3	X	32.0	5.3	—	—	—	—	—	—	—	0.02	99.9
6	Ras Tenoum	50.0	10.2	3.1	8.2	29.6	3.1	2.0	30.6	6.1	—	—	—	—	—	—	7.1	0.02	99.8
7	Mersa Baqush	42.3	8.2	6.5	15.2	32.6	1.6	2.7	19.6	11.4	X	X	—	—	—	—	X	0.04	94.0
8	Mersa Matruh	48.6	18.4	3.1	7.7	23.8	1.5	1.5	35.4	6.9	—	—	—	—	—	—	—	0.03	99.1
	Average second zone	48.9	13.0	4.0	11.3	33.5	1.9	1.2	26.8	5.5	X	X	—	—	—	—	1.3	0.03	98.8
	ABU SIR BAR MAIN MONASTERIAN 25m. FIRST ZONE																		
9	Tabiet Abu Qir	55.2	35.1	17.9	21.2	2.0	6.0	X	11.9	3.3	—	X	X	—	X	—	—	1.45	61.7
10	Tabiet el Tawfiquia top	44.8	38.7	23.0	22.0	X	7.9	X	2.6	2.1	X	—	—	1.0	—	X	—	0.31	88.2
11	Tabiet el Tawfiquia 10m. below top	51.5	44.2	19.7	21.8	—	3.4	1.4	6.1	1.4	—	—	X	—	—	—	—	0.31	89.3
12	El Montazah, Alexandria	35.8	41.8	25.0	23.1	X	1.9	X	4.3	1.4	X	X	—	—	—	—	—	0.36	89.5
13	Zizinia, Alexandria	23.0	40.7	24.2	26.6	—	2.4	X	1.6	1.2	X	X	—	X	—	X	—	1.28	43.6
14	Mex	54.7	39.4	7.7	18.4	1.5	X	—	21.8	4.4	X	3.4	—	—	—	X	1.9	0.03	99.7
15	Dekheila	61.3	32.5	4.6	18.5	3.7	X	1.8	28.7	8.3	—	—	—	—	—	—	1.8	0.04	99.9
	Average first zone	46.6	38.9	17.5	16.9	1.2	3.3	X	11.0	3.2	X	X	X	X	X	X	X	0.46	81.6
	SECOND ZONE																		
16	Agami	79.4	29.0	1.6	14.5	1.6	X	1.6	35	12.9	—	1.6	—	—	—	—	1.6	0.43	99.4
17	El Metras	61.8	22.7	3.4	24.4	1.7	2.5	—	33.5	10.1	—	X	—	—	—	—	X	0.01	99.9
19	Sidi Kreir, top	86.4	20.5	2.6	30.8	2.6	2.6	—	28.2	7.7	—	2.6	—	—	—	—	2.6	0.07	99.9
20	Sidi Kreir 7m. below top	69.8	21.4	2.2	25.8	2.3	1.1	—	28.1	6.7	—	3.7	—	—	—	—	9.0	0.05	99.6
22	Abu Sir	66.4	13.5	X	33.6	X	X	—	24.0	4.8	—	X	—	—	—	—	20.2	0.01	99.9
23	Burg el Arab top	60.7	26.0	1.6	26.8	1.6	X	X	33.3	6.5	—	X	—	—	—	X	X	0.01	99.9
24	Bur el Arab 4m. below top	72.6	18.8	1.2	32.9	—	3.5	—	31.8	4.7	—	—	—	—	—	—	4.7	0.01	99.9
26	El Hammam	63.3	11.6	X	8.0	—	1.8	1.8	17.9	6.2	—	—	—	—	—	—	51.8	0.02	99.9
31	El Dabaa	60.2	27.8	4.0	20.5	2.0	5.3	—	31.8	6.6	X	X	X	—	—	—	—	0.01	99.2
	Average second zone	69.1	20.1	2.0	24.2	1.4	2.1	X	29.3	6.2	X	1.2	X	—	—	X	10.1	0.07	99.7

Table I *(cont.)*

No. of sample	LOCALITY	Iron Ores*	Amphi-boles	Pyrox-enes	Epidotes	Tour-maline	Garnet	Stau-rolite	Zircon	Rutile	Kyanite	Biotite	Titanite	Apatite	Monazite	Sillimanite	Anatase	Index Figure	Carbonate content
	GEBEL MARYUT BAR TYRRHENIAN 35m. FIRST ZONE																		
32	Gezieret Umm Segheiw (T)	32.9	46.1	12.3	24.5	X	1.8	X	7.9	3.1	X	—	—	—	—	X	—	0.06	98.6
33	Sidi Kreir (T)	23.2	44.8	12.7	29.0	X	2.3	X	5.9	3.2	X	X	—	—	—	—	—	0.10	98.0
34	Karm Kasem top........................	31.2	44.5	17.5	23.1	—	X	X	8.1	3.8	1.3	X	X	—	—	—	—	0.39	92.8
35	Karm Kasem 10m. below top	33.0	52.7	25.2	11.0	X	X	—	8.6	1.0	X	1.4	—	—	—	—	—	0.08	97.2
36	Karm el Hurra	35.1	52.2	16.7	18.8	X	X	X	5.7	2.2	X	X	X	X	—	—	—	0.10	96.8
37	Ikingi Maryut	24.2	51.8	18.0	18.0	2.0	X	1.0	5.8	1.4	X	X	X	—	—	—	—	0.12	96.6
38	Ikingi Maryut 500m. north of 37	18.9	58.3	10.6	24.0	X	X	X	2.8	1.4	X	X	X	—	—	—	—	0.23	97.9
39	3 km. east of Behig	34.7	40.7	29.2	16.9	X	2.5	X	5.3	1.2	X	1.2	X	X	—	—	X	0.57	89.8
40	Behig	51.1	39.0	14.7	27.5	X	2.6	1.3	9.6	2.6	X	—	—	—	—	—	X	0.03	98.5
	Average first zone	31.5	47.8	17.3	21.4	X	1.3	X	6.6	2.2	X	X	X	X	—	X	X	0.19	96.3
	SECOND ZONE																		
41	Burg el Arab	65.6	22.7	4.2	31.9	2.8	1.4	X	27.7	5.7	X	X	—	—	—	X	X	0.03	97.8
42	El Hammam	62.2	23.1	3.4	27.6	1.1	1.1	—	27.6	12.4	X	X	—	—	—	1.1	1.1	0.03	98.7
43	El Emayid	60.0	24.0	3.6	27.6	2.7	1.8	—	24.9	9.8	X	—	—	—	—	X	3.6	0.02	94.5
44	7 km. west of Emayid	66.0	26.3	2.6	27.2	2.6	1.7	X	29.8	7.9	X	—	—	—	—	—	—	0.03	94.9
45	Alamein	58.2	28.8	2.6	20.5	1.3	X	1.3	33.4	8.3	X	1.3	X	—	—	X	—	0.02	98.2
	Average second zone	62.4	25.0	3.3	27.0	2.1	1.3	X	28.7	9.6	X	X	X	—	—	X	1.1	0.03	96.8
	KHASHM EL EISH BAR MILAZZIAN 60m. FIRST ZONE																		
47	Ikingi road, 1 km. west of Cairo-Alexandria road (T)	58.2	40.8	16.3	24.5	X	1.4	X	12.2	2.7	—	—	—	—	—	—	—	0.21	92.7
48	Hawariya station (T)	46.5	38.0	15.4	19.0	1.8	1.8	—	18.4	3.7	X	X	—	—	—	X	—	0.02	98.4
49	13 km. west of Ikingi (T)	77.0	19.8	2.5	32.1	5.0	1.2	1.2	27.1	9.8	1.2	—	—	—	—	—	—	0.08	95.1
50	3 km. east of Behig (T)...............	48.7	41.0	15.9	22.0	2.1	2.0	X	11.8	2.1	X	—	—	—	—	—	2.0	0.05	98.3
57	Abu Ragouh Tomb	70.1	36.9	11.6	13.6	X	2.9	X	25.2	5.8	—	X	—	X	—	—	—	0.16	94.3
58	Kingi Maryut	46.2	31.7	13.9	29.3	X	3.0	3.0	12.0	4.8	X	—	X	—	—	—	—	0.11	96.2
	Average first zone	57.8	34.6	12.3	22.9	1.9	2.0	1.1	17.8	4.8	X	X	X	X	—	X	X	0.11	95.8
	KHASHM EL EISH BAR MILAZZIAN 60m. SECOND ZONE																		
51	5 km. south east of burg el Arab (T)	62.5	21.8	4.8	16.9	4.8	X	3.2	37.1	7.3	1.6	—	—	—	—	—	2.4	0.11	96.4
52	South of Burg el Arab (T)	50.6	22.6	4.8	20.8	3.1	1.3	X	37.0	6.1	X	X	X	—	—	—	1.7	0.06	98.7
53	El-Hammam (T)	52.5	22.0	3.7	29.9	1.2	1.2	1.2	31.0	7.3	X	X	—	—	—	—	1.2	0.01	99.9
54	1 km. south of 53 (T)	57.8	31.6	3.2	36.0	1.6	2.4	—	16.0	7.6	X	X	—	—	—	—	X	0.15	93.5
55	200 m. west of 54 (T)	61.6	32.4	3.5	28.2	2.1	1.4	—	22.7	8.3	X	X	—	—	—	—	—	0.14	95.9
56	El Emayid (T)	54.9	26.0	7.0	27.5	1.6	2.7	1.1	23.8	8.6	X	—	—	—	—	—	1.1	0.03	95.5
59	Burg el Arab	60.2	15.2	4.0	16.8	X	2.4	X	39.2	13.6	1.6	—	X	—	—	—	4.8	0.14	95.8
60	El Hammam	54.1	39.0	4.3	29.3	1.8	X	X	18.3	3.0	X	—	—	—	—	1.2	X	0.03	95.2
61	Khashm el Eish, top	58.4	27.0	6.1	25.8	1.3	X	X	22.1	12.3	1.8	X	—	—	—	—	1.2	0.04	93.3
62	Khashm el Eish, 5m. below top ...	64.2	30.2	6.4	24.3	2.0	X	2.0	20.3	10.4	X	X	—	—	—	X	1.5	0.05	97.0
63	Khashm el Eish, 10m. below top...	57.6	28.3	4.5	28.3	X	X	X	21.6	9.7	2.2	X	X	—	—	—	X	0.05	97.0
64	Khashm el Eish, 20m. below top...	69.3	23.2	3.2	29.6	1.6	3.2	3.2	24.8	7.2	1.6	X	X	—	—	X	—	0.05	97.2
65	2 km. west of Khashm el Eish	56.2	14.6	2.7	37.0	2.6	2.6	X	30.4	6.6	X	X	X	—	—	—	—	0.03	98.0
66	Gebel Bein Gaber	62.1	14.4	1.4	36.0	1.4	2.2	X	36.0	6.5	—	—	—	—	—	1.4	—	0.11	89.7
68	South east of el Alamein	58.0	26.2	2.0	31.0	2.1	2.1	1.4	18.6	12.4	1.4	X	—	—	—	—	2.1	0.04	98.8
	Average second zone	58.7	25.0	4.2	27.6	1.9	1.6	1.1	26.6	8.5	1.1	X	X	—	—	X	1.2	0.07	96.1

Table I *(cont.)*

No. of sample	LOCALITY	Iron Ores*	Amphi-boles	Pyrox-enes	Epidotes	Tour-maline	Garnet	Stau-rolite	Zircon	Rutile	Kyanite	Biotite	Titanite	Apatite	Monazite	Sillimanite	Anatase	Index Figure	Carbonate content
	SICILIAN BARS																		
	ALAM EL KHADEM — BAR SICILIAN D 80m.																		
70	El Qarn	60.0	24.6	3.3	29.2	1.2	2.2	X	28.0	7.2	X	X	X	—	—	—	1.2	0.18	93.3
71	15 km. west of 70	72.9	15.2	1.8	29.2	1.2	2.9	1.2	29.8	15.2	1.2	—	—	—	—	—	2.3	0.18	92.7
72	Alam Nayil	59.8	29.5	1.8	33.7	1.8	1.2	X	24.5	3.7	X	1.2	—	—	—	X	X	0.18	93.6
73	Alam el Khadem top	67.0	11.5	6.9	28.4	1.5	2.3	X	33.1	14.6	X	—	—	—	—	—	—	0.14	93.7
74	Alam el Khadem 5m. below top	63.3	15.2	1.6	28.0	1.6	7.2	2.4	23.2	16.0	2.4	—	X	—	—	1.6	—	0.10	91.3
75	Alam el Khadem 15m. below top	66.0	11.5	X	27.4	1.7	1.7	1.7	45.0	7.7	X	X	—	—	—	X	—	0.13	93.7
76	Alam el Buweib	62.9	11.4	2.1	34.6	2.7	3.3	X	33.6	8.8	X	—	—	—	—	2.0	—	0.11	94.3
	Average	64.6	17.0	2.6	30.1	1.7	3.0	1.2	31.0	10.4	1.1	X	X	—	—	X	X	0.15	93.2
	EL MIKHERTA — BAR SICILIAN C 85m.																		
77	Elwet el Maghagi	52.7	36.8	10.4	23.6	2.2	3.3	X	14.3	6.6	X	X	X	—	—	—	X	0.54	69.0
78	Elwet el Temmir	74.4	11.2	4.3	29.0	X	4.3	X	35.9	12.8	X	X	—	—	—	—	—	0.30	84.9
79	Makman Gebril	69.7	10.1	1.8	30.6	—	X	X	44.5	10.1	X	—	—	—	—	—	—	0.35	87.5
	Average	65.6	19.7	5.5	27.7	1.0	2.8	X	31.6	9.5	X	X	X	—	—	—	X	0.40	86.5
	RAQABET EL HALIF — BAR SICILIAN B 90m.																		
80	Elwet Abu Makhluf	53.2	27.3	2.1	39.6	X	1.6	1.1	19.2	6.9	X	X	—	—	—	—	X	0.26	83.6
81	Raqabet el Halif	53.3	33.2	2.4	28.3	1.5	1.5	X	23.4	6.8	X	X	—	—	—	—	X	0.22	86.0
82	Alam Imbayih	57.9	20.3	8.4	30.1	2.1	4.9	4.9	20.3	6.3	1.4	X	—	—	—	—	—	0.17	94.5
	Average	54.8	26.9	4.3	32.6	1.4	2.6	2.3	21.0	6.7	X	X	—	—	—	—	X	0.22	88.1
	ALAM SHALTUT — BAR SICILIAN A 110m.																		
83	Alam el Mireibet	58.2	33.9	2.3	30.7	X	3.2	2.3	18.6	5.6	1.9	X	—	—	—	—	—	0.27	83.2
84	Alam Shaltut	66.0	21.7	1.8	28.9	X	1.2	1.8	33.7	7.8	2.4	—	—	—	—	—	—	0.25	83.6
85	5 km. west of 84	50.5	39.8	3.3	35.4	2.2	3.3	2.8	4.4	2.2	3.3	X	X	—	—	1.7	X	0.42	81.3
	Average	58.2	31.8	2.5	31.7	1.2	2.6	2.3	18.9	5.2	2.5	X	X	—	—	X	X	0.31	82.7

x Less than 1%.

* The iron ore frequencies were not taken in consideration when calculating the frequencies of other heavy minerals.

(T) Transverse or secondary bar.

TABLE II

AVERAGE RELATIVE FREQUENCIES AND RANGE OF THE HEAVY MINERALS OF THE PLEISTOCENE SAND BARS AND THE RECENT BEACH SEDIMENTS

FIRST ZONE

	Recent Beach		Abu Sir Bar Main Monasterian		Gebel Maryut Bar Tyrrhenian		Khasm el Eish Bar Milazzian	
	average	range	average	range	average	range	average	range
Iron Ores *	27.2	13.1-63.0	46.6	23.0-61.3	31.5	18.9-51.1	57.8	46.2-77.0
Amphiboles	41.1	23.2-53.7	38.9	32.5-44.2	47.8	39.0-58.3	34.6	31.7-41.0
Pyroxenes	24.7	20.0-32.8	17.5	4.6-25.0	17.3	10.6-29.2	12.3	2.5-16.3
Epidotes	26.3	17.7-34.8	16.9	18.4-26.6	21.4	11.0-29.0	22.9	13.6-32.1
Tourmaline	1.2	0 - 8.6	1.2	0 - 3.7	0.7	0 - 2.0	1.9	0.7- 5.0
Garnet	1.6	0 -13.0	3.3	0.5- 7.8	1.3	0.4- 2.6	2.1	1.2- 3.0
Staurolite	0.8	0 - 1.5	0.9	0 - 1.8	0.7	0 - 1.3	1.1	0 - 3.0
Zircon	1.7	0.3-15.6	11.0	1.6-28.7	6.6	2.8- 9.6	17.8	11.8-27.1
Rutile	0.7	0 - 4.2	3.2	1.2- 8.3	2.2	1.2- 3.6	4.8	2.0- 9.8
Kyanite	0.2	0 - 0.7	0.3	0 - 0.5	0.6	0.3- 1.3	0.6	0 - 1.2
Biotite	0.9	0 - 8.4	0.7	0 - 3.4	0.6	0 - 1.4	0.3	0 - 1.0
Titanite	0.1	0 - 0.8	0.2	0 - 0.7	0.2	0 - 0.4	0.1	0 - 0.5
Apatite	0.3	0 - 1.5	0.3	0 - 1.0	0.1	0 - 0.4	0.2	0 - 1.0
Monazite	0.1	0 - 1.0	0.1	0 - 0.7	—		—	
Sillimanite	0.1	0 - 0.5	0.3	0 - 0.8	0.1	0 - 0.9	0.1	0 - 0.6
Anatase	—		0.6	0 - 1.9	0.1	0 - 0.6	0.3	0 - 2.0
Index Figure	3.36	0.03-11.5	0.56	0.03-1.45	0.19	0.03-0.57	0.11	0.02-0.21
Carbonate content	50.9	2.4-89.7	81.6	43.6-99.9	96.3	89.8 98.6	95.8	92.7-98.4

SECOND ZONE

	Recent Beach		Coastal Bar Late Monasterian		Abu Sir Bar Main Monasterian		Gebel Maryut Bar Tyrrhenian		Khasm el Eish Bar Milazzian		Sicilian Bars Sicilian	
	average	range	average	range	average	range	average	range	average	range	average	range
Iron Ores *	49.5	33.0 - 62.4	48.9	42.3 - 55.3	69.1	60.2 - 86.5	62.4	58.2 - 66.0	58.7	50.6 - 69.3	60.8	50.5 - 74.4
Amphiboles	21.5	66.5 - 59.1	13.0	8.1 - 18.4	20.1	11.6 - 29.0	25.0	22.7 - 28.9	25.0	14.4 - 39.0	23.8	10.1 - 39.8
Pyroxenes	9.4	1.2 - 23.3	4.0	1.3 - 9.0	2.0	0.9 - 4.0	3.3	2.6 - 4.2	4.2	1.4 - 7.0	3.7	0.8 - 8.4
Epidotes	14.7	4.3 - 36.4	11.3	7.7 - 15.2	24.2	8.0 - 33.6	27.0	20.5 - 31.9	27.6	16.8 - 37.0	30.5	22.6 - 39.6
Tourmaline	36.1	5.4 - 53.1	33.5	23.8 - 48.5	1.4	0 - 2.6	2.1	1.1 - 2.8	1.9	0.7 - 4.8	1.3	0 - 2.7
Garnet	1.9	0 - 8.6	1.9	1.2 - 3.2	2.1	0.8 - 5.3	1.3	0.6 - 1.8	1.6	0.6 - 3.2	2.8	0.9 - 7.2
Staurolite	0.9	0 - 4.2	1.2	0 - 2.7	0.5	0 - 1.8	0.6	0 - 1.3	1.1	0 - 3.2	1.6	0 - 4.9
Zircon	11.6	0 - 32.3	26.8	12.6 - 35.4	29.3	17.9 - 35.5	28.7	24.9 - 33.4	26.6	16.0 - 37.1	25.6	4.4 - 45.0
Rutile	3.3	0 - 9.9	5.5	2.3 - 11.4	6.2	4.7 - 12.9	9.6	5.7 - 12.4	8.5	3.0 - 13.6	8.0	2.2 - 15.2
Kyanite	0.3	0 - 1.6	0.1	0 - 0.6	0.1	0 - 0.7	0.7	0.6 - 0.9	1.0	0 - 2.2	1.3	0.5 - 3.3
Biotite	0.2	0 - 1.5	0.6	0 - 2.9	1.2	0 - 3.7	0.5	0 - 1.3	0.5	0 - 0.8	0.4	0 - 1.2
Titanite	—		—		0.1	0 - 0.7	0.1	0 - 0.6	0.2	0 - 0.8	0.2	0 - 0.8
Apatite	—		—		—		—		—		—	
Monazite	—		—		—		—		—		—	
Sillimanite	—		—		0.1	0 - 0.8	0.7	0 - 1.1	0.3	0 - 1.4	0.3	0 - 2.0
Anatase	—		1.3	0 - 7.1	10.1	0 - 51.8	1.1	0 - 3.6	1.2	0 - 4.8	0.7	0 - 2.3
Index Figure	0.006	0.001 0.01	0.03	0.01 - 0.10	0.07	0.01 - 0.43	0.03	0.02 - 0.03	0.07	0.01 - 0.14	0.27	0.10 - 0.54
Carbonate content	96.7	83.7 - 99.9	98.8	94.0 - 99.9	99.7	99.2 - 99.9	96.8	94.5 - 98.7	96.1	89.7 - 98.8	78.6	69.0 - 94.5

* The iron ore frequencies were not taken in consideration when calculating the frequencies of other heavy minerals.



FIG. I Relative Frequencies of the main minerals recorded from the two zones of the different Bars

Iron ores were not taken in consideration when calculating the frequency of other minerals

Lamellibranchia from the Nubian Sandstone Series of Egypt[1]

by

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Read by Mahmoud Ibrahim Attia
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Introduction.

The fossils here described belong to the collection of the Geological Survey of Egypt, and have been submitted to me for examination by Dr. M. I. Attia (the Director) at the suggestion of Dr. K. S. Sandford. They were found at three localities in the neighbourhood of Aswan, on the Nile, see sketch map, Plate I, and are of interest both as supplementing the scanty records of the occurrence of fossil invertebrates in the Nubian Sandstone, and as affording further evidence of the presence of non-marine as well as of marine mollusca in this formation. A very similar collection from the same area was described by R. B. Newton (1909). Summaries of earlier records of fossils from the Nubian Sandstone are given by Newton (*loc. cit.*) and by Blanckenhorn (1921, pp. 57 - 60). Of more recent discoveries, the most important are the fossil plants found by Barthoux near the top of the Nubian Sandstone at Aswan and described by Fritel (Barthoux and Fritel, 1925), and the marine Cretaceous invertebrates recorded by Attia and Murray (1952) from localities in the Wadi Qena area.

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(1) Communication présentée en séance du 6 décembre 1954.

The fossils described by Newton included four species of non-marine lamellibranchs found in a ferruginous rock at Jowiokl, 40 kms. south of Aswan. They were all considered to be new and were described under the name *Unio humei*, *U. jowikolensis*, *U. crosthwaitei* and *Mutela mycetopoides*. An annelid worm, identified as *Galeolaria filiformis* (J. de C. Sowerby) and apparently marine, occurred encrusting some of the *Unio* shells. Newton also described a representative of the marine genus *Inoceramus* from a horizon of the Nubian Sandstone "not more than 20 metres above the old igneous rocks" near the western end of the Aswan dam, assigning it to a new species, *I. balli*. He suggested that all the fossils were of Senonian age. Fritel, however, from a study of the fossil plants found at Aswan, was "disposé à considérer la florule découverte par M. J. Barthoux au sommet du grès de Nubie comme devant être située dans la série Eocrétacée, ou tout au moins à cheval sur celle-ci et la partie supérieure du Mésocrétacé." He thus considered the upper part of the Nubian Sandstone of the Aswan district to be not later than Cenomanian. The marine invertebrates recorded by Attia and Murray (1952) were undoubtedly of Albian-Cenomanian age, but came from localities a considerable distance north of Aswan.

The fossils which are the subject of the present paper are all preserved in highly ferruginous rock, and are mostly more or less imperfect internal moulds, although those from the locality(1) retain some of the shell replaced by a ferruginous mineral. Except for those described under *Iridina* (*Pleiodon*), there is no indication of their former hinge-structure. Those from the locality (2) appear to belong to the Unionacea and therefore to be non-marine. The specimens from the locality (1), however, have been described under the marine genera *Isocardia* and *Cyprina*, while the locality (3) yielded a small *Inoceramus*. The localities and the species represented at each are as follows :—

Locality (1).

North of "Alluvial Working" in Wadi Abu 'Agag and about 11.5 kms. east of Aswan; ferruginous sandstone overlying upper oolitic iron-ore band (B_2 - band).

Isocardia aegyptiaca - sp. nov.
Cyprina humei - sp. nov.

Locality (2).

North of Wadi el-Kirkubôb and about 19 kms. east of Aswan; ferruginous sandstone overlying upper oolitic iron-ore band (B_2-band)

Unio jowikolensis - Newton.
Unio attiai - sp. nov.
Unio nubianus - sp. nov.
Iridina (*Pleiodon*) *aswanensis* - sp. nov.
Iridina (*Pleiodon*) sp.

Locality (3).

Rounded feature with elevation point 283 north of Wadi el-Kirkubôb and about 22 kms. east of Aswan; found loose on the slope, but undoubtedly from the upper sandstone series about 15 metres above the uppermost iron-ore band. Fossil wood was found *in situ* at this horizon.

Inoceramus sp.

This is a small and imperfect specimen which probably belongs to the species *I. balli* - Newton. It will not be described.

DESCRIPTION OF THE FOSSILS

Family UNIONIDAE.

Genus *Unio* Retzius, 1788.
Unio Jowikolensis - Newton
PLATE 2, FIG. 2.

Newton, 1909, p. 389, pl. 20, figs. 7 - 10.

Two specimens, the larger with its two valves displaced, may be referred to this species. The length of the larger one is 40 mm. The outline is rectangularly ovate, the height slightly exceeding one-half of the length. The broadly rounded umbo, which lies at about the anterior two-fifths of the length, scarcely projects above the straight postero-dorsal outline. The latter and the ventral margin are almost parallel. In the larger specimen the posterior slope is evenly rounded, but in the other it has an obtuse ridge. The most similar species described from the Cretaceous of Europe is *U. gallo-*

provincialis-Matheron (1842, p. 168, pl. 23, fig. 1), which is more elongate.

Occurrence. — North of Wadi el-Kirkubôb and about 19 kms. east of Aswan.

UNIO ATTIAI - sp. nov.
PLATE 2, FIGS. 3a, b.

Material. — Two specimens, of which the one figured is taken as holotype.

Description. — Moderately large, ovate, length not greatly exceeding height, inflation moderate. Anterior, ventral, and posterior margins forming an uninterrupted curve, ventral margin strongly convex. Umbonal region prominent and well inflated; umbo very slightly anterior to median. Beaks feebly prosogyrous. Posterior slope with or without an obtuse ridge. Dentition unknown.

Measurements of Holotype. — Length 62.5 mm., height 50.3 mm., inflation 34.5 mm. The paratype, which is very imperfect, is slightly larger.

Remarks. — No closely comparable Cretaceous Unionid has been described previously. *Unio ovatus* - say (figured by Reeve, 1866, pl. 31, fig. 164) is a Recent species of similar outline.

Occurrence. — North of Wadi el-Kirkubôb and about 19 kms. east of Aswan.

UNIO NUBIANUS - sp. nov.
PLATE 2, FIG. 1.

Material. — Three specimens, of which the one figured is taken as holotype. All are imperfect.

Description. — Of medium size, elongate-ovate, subequilateral, of moderate inflation; height about three - fifths of lentgh. Umbones broadly rounded, moderately prominent; anterior and posterior dorsal outlines sloping gently and equally towards the extremities. Ventral margin of rather feeble convexity. The most inflated part of the shell is posterior to the umbones, but the posterior slope without a ridge.

Measurements of Holotype. — Length (original) c. 62 mm., height 37 mm., inflation 30 mm. One of the paratypes, less complete, is larger.

Occurrence. — North of Wadi el-Kirkubôb and about 19 kms. east of Aswan.

Family MUTELIDAE
Genus *Iridina* Lamarck, 1819
Subgenus *Pleiodon* Conrad, 1834
Iridina (*Pleiodon*) *aswanensis* - sp. nov.
PLATE 2, FIGS. 4a, b

Material. — The holotype only.

Description. — Rectangularly-ovate, length equal to twice height. Umbones broadly rounded, projecting very slightly above posterodorsal outline, and placed at the anterior two-fifths of the length. Extremities evenly rounded, posterior slope without carina. Pseudotaxodont teeth of moderate size, extending along hinge-margin both in front of and behind umbones.

Measurements. — Length 45 mm., height 22.5 mm., inflation 23 mm.

Remarks. — This and the specimen described next are of interest as showing that the genus *Iridina*, characteristically African at the present day, existed in Egypt in Cretaceous times. The pseudo-taxodont teeth are larger than in the modern species of *Iridina* s. str., and the form now described is, therefore, included in the subgenus *Pleiodon*. It is more elongate than the Recent *Iridina* (*Pleiodon*) *ovata* - Swainson, which also differs in its oblique posterior truncation and in its strongly convex ventral margin, the general direction of which is divergent from the hinge-margin.

Occurrence. — North of Wadi el-Kirkubôb and about 19 kms. east of Aswan.

IRIDINA (PLEIODON) ? sp.
PLATE 3, FIGS. 1a, b.

A broken specimen, consisting of the anterior part of an internal mould and fortunately retaining the umbones and much of the hinge-line, probably represents a second species of *Iridina* (*Pleiodon*), which differs considerably in form from the one described above. Its original length was probably about 60 mm. and its inflation (about 41.5 mm.) is considerable. When complete, the shell was probably slightly inequilateral. The umbonal region is broadly rounded and prominent. the beaks well incurved. There is no posterior carination of the valves. The hinge-line is almost straight, and impressions of small taxodont teeth extend along it on both sides of the beaks.

Although this specimen could conceivably have belonged to a smooth, gibbose species of Arcidae, it is more probable that it was non-marine and referable to *Iridina* (*Pleiodon*). It is much more gibbose and less elongate than the unnamed *Pleiodon* recorded by the present writer (Cox, 1926, p. 69, pl. 9, figs. 5a, b) from the Pleistocene Kaiso Beds of Lake Albert, Uganda.

Occurrence. — North of Wadi el-Kirkubôb and about 19 kms. east of Aswan.

Family ISOCARDIIDAE.

Genus *Isocardia* Lamarck, 1799

Isocardia aegyptiaca - sp. nov.

PLATE 3, FIGS. 3a, b, c.

Material. — The holotype (figured), together with about three very imperfect specimens.

Description. — Gibbose, subtrigonal, with strongly prosogyrous, spirally incoiled, subterminal beaks. Dorsal outline strongly convex, rising prominently above the beaks and forming a continuous curve with the low posterior margin. Ventral margin strongly and

asymmetrically convex, anterior extremity low, with its upper margin inturned abruptly, so that there is a deep hollow below the coiled beaks. Posterior slope not carinate.

Surface with conspicuous, irregular growth - rugae. Internal characters unknown.

Measurements of Holotype. — Length 36 mm., height 32 mm., inflation 33 mm.

Remarks. — The external morphology of this shell is suggestive of the genus *Isocardia*, although it is improbable that its hinge - structure, if known, would prove to be similar to that of *I. humana* (Linné), better known as *I. cor* (Linné), the Recent species which is the type of the genus. The most similar described Cretaceous species is *I. similis* - J. de C. Sowerby (See Woods, 1907, p. 151, fig. 25), a rare form from the Lower Greensand of England, the hinge - structure of which has not yet been described. *I. similis* is much larger than the Nubian Sandstone species and somewhat less gibbose in proportion to its size. Hamlin (1884, p. 43, pl. 5. figs. 2a - c) described a species *I. merrilli* from the Albian-Cenomanian of Syria. Founded on internal moulds, this differs from the species now described in its much larger size and taller form, and in the position of its umbones, which project beyond the anterior end of the shell.

Occurrence. — North of "Alluvial Working" in Wadi Abu 'Agag and about 11.5 kms. east of Aswan.

Family CYPRINIDAE.

Genus *Cyprina* Lamarck, 1818

Cyprina humei - sp. nov.

PLATE 3, FIGS. 2a, b.

Material. — The holotype (figured) and one imperfect specimen.

Description. — Ovate, gibbose, very inequilateral, height about four-fifths of length. Beaks strongly prosogyrous, placed at about the anterior seventh of the length, the dorsal outline of the shell strongly convex and rising well above them. Posterior margin short owing

to the steep posterior descent of the dorsal margin, ventral margin rather strongly convex. Anterior extremity forming a low, almost vertically truncated projection. Posterior slope not carinate. Internal characters unknown.

Measurements of Holotype. — Length 46 mm., height 37 mm., inflation 36 mm.

Remarks. — The external morphology of this shell is suggestive of that of some representatives of the Cyprinidae and Isocardiidae, but it cannot be identified with any described Cretaceous form, although many species of these families had a wide geographical distribution. It resembles most closely *Cyprina cordata* - Sharpe (1850, p. 182, pl. 15, figs. 2a, b; Pervinquière, 1912, p. 223, pl. 16, figs. a, 2), which occurs in Cenomanain beds in northern Africa and southern Italy, although Sharpe stated that in Portugal it is found in the Hippurite Limestone. The species in question, however, is rather less gibbose and tapers less towards its posterior end.

Occurrence. — North of "Alluvial Working" in Wadi Abu 'Agag and about 11.5 kms. east of Aswan.

NOTE

While visiting the district east of Aswan during May 1954 accompanying some foreign experts, an officer of the Geological Survey found a fossil (Inoceramus sp.) lying on the surface of the ground at a point three kilometres to the north-east of locality No. 1.

This fossil has been photographed and the photographs sent to Dr. L.R. Cox of the Department of Geology of the British Museum, London for identification. Dr. Cox wrote as follows:—

"The specimen of which you have sent photographs (see PLATE IV) belongs to the genus *Inoceramus* and I think that it must belong to the species *I. balli*—Newton, described in his 1909 paper

on fossils from the Nubian Sandstone. It has the strong convexity, the well incurved umbones, and the strong concentric ribbing indicated in Newton's figures of his type specimen, but it has not the elongate hinge margin, part of which may, however, have been broken away. It certainly does not belong either to *I. labiatus* (Schlotheim) or to *I. regularis* — d'Orbigny, the only other species of the genus recorded by Fourtau in his catalogue of the Gretaceous lamellibranchs of Egypt. As it is a species recorded only from the Nubian Sandstone of the Aswan district, it does not throw any light on the precise age of the fossiliferous beds. *I. balli* was originally misidentified as *I. Crippsi* — Mantell, a Cenomanian species in which the umbones are much less prominent and less strongly incurved. Species from other regions which are most similar to *I. balli* are of Turonian and Senonian age".

DISCUSSION

The fossils described above throw no light on the precise geological age of the part of the Nubian Sandstone from which they were obtained. The *Inoceramus* from the Locality (3) indicates that the beds belong to the Cretaceous system, but it is not identifiable specifically. It might have been expected that representatives of such marine genera as *Isocardia* and *Cyprina* would have proved to belong to species known to occur in the normal marine Cretaceous of northern Egypt or of adjacent areas such as Syria, and that they would, therefore, have been of some use in correlation. The two species from Locality (1) have proved, however, to be undescribed.

Non-marine deposits with Unionidae are known from various stages of the Cretaceous system in Europe and Asia, as well as further afield. Besides the Lower Cretaceous Wealden deposits, such formations include the Campanian deposits of Provence from which several species of Unionidae were long ago described by Matheron (1842), and the Gosau beds of Austria, which have yielded the species *Unio cretaceus* - Zittel. The species of *Unio* now described bear no close resemblance to any known from these other areas, and, as

nothing is known of their hinge-structure, no discussion of their precise affinities is possible. The occurrence of two species of *Iridina* (*Pleiodon*), identifiable as such by their pseudo-taxodont dentition, is, however, noteworthy, as *Iridina* and its subgenus *Pleiodon* are confined to Africa at the present day and no fossil representatives have ever been found elsewhere. Newton, on less certain evidence, identified another typically African genus, *Mutela*, among the Nubian Sandstone fossils from Jowikol which he described in 1909, and the importance of this identification, as indicating the antiquity and endemic nature of the African freshwater molluscan fauna, was pointed out by Stromer (1917, pp. 408, 412). It is, therefore, of interest to find confirmation of this observation in the fossils now described.

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EXPLANATION OF PLATE 2.

Fig. 1 — *Unio nubianus* sp. nov. Holotype. North of Wadi el-Kirkubôb and about 19 kms. east of Aswan.

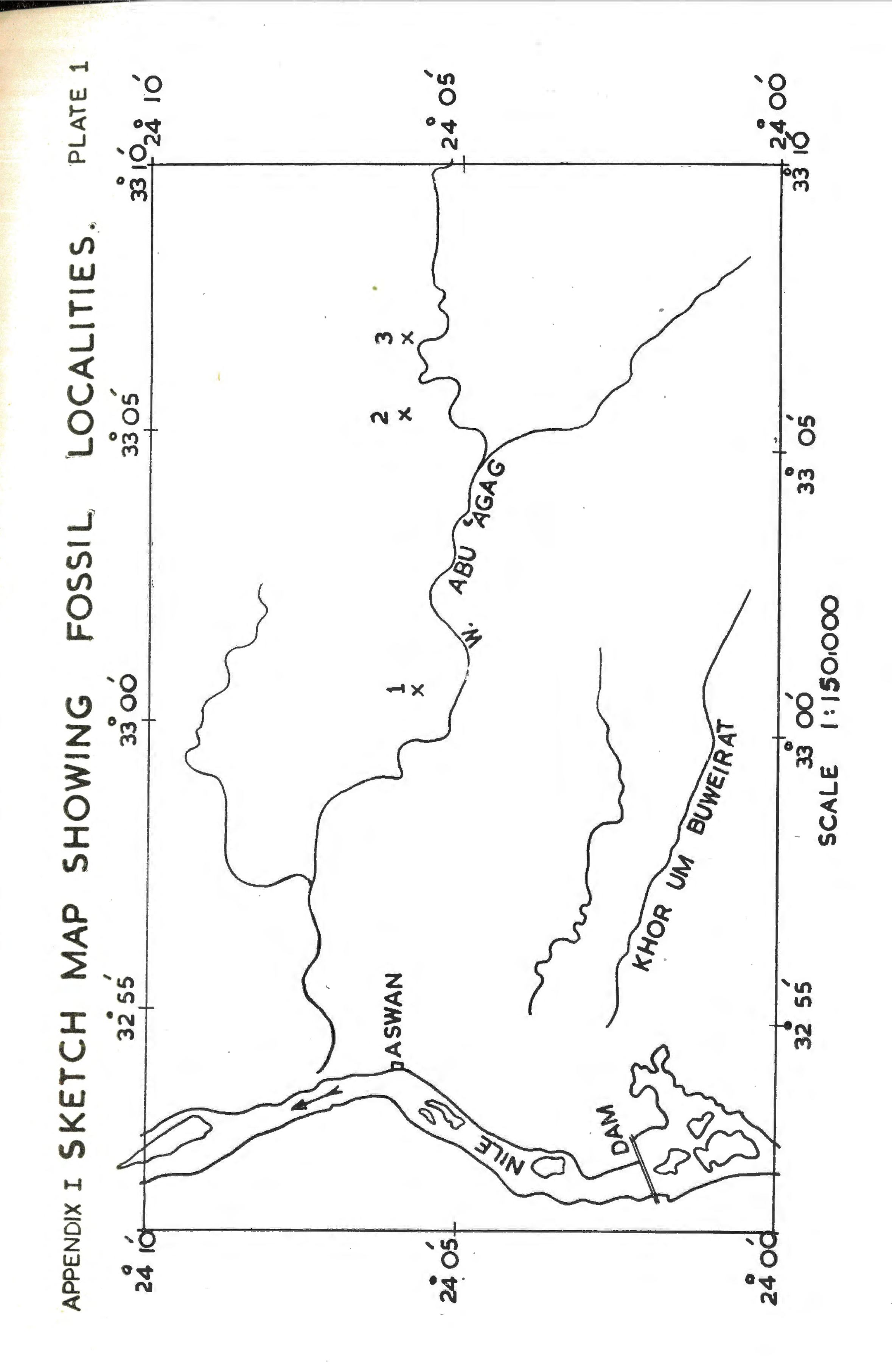
Fig. 2 — *Unio jowikolensis* - Newton, Same locality.
Figs. 3a, b — *Unio attiai* — sp. nov. Holotype. Same locality.
Figs. 4a, b — *Iridina (Pleiodon) aswanensis* — sp. nov. Holotype. Same locality.

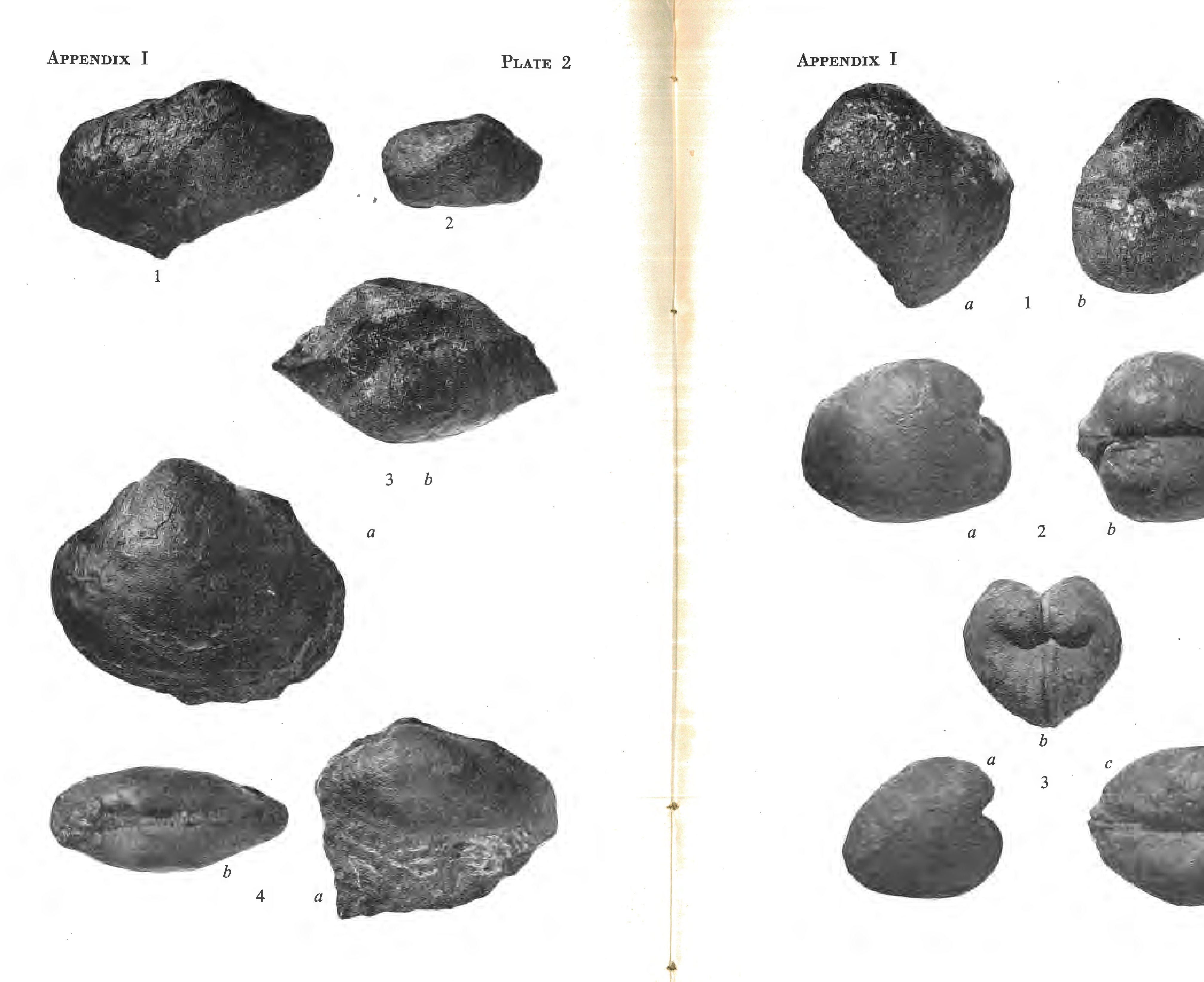
EXPLANATION OF PLATE 3.

Figs. 1a, b — *Iridina (Pleiodon)* — North of Wadi el-Kirkubob and about 19 kms. east of Aswan.

Figs. 2a, b — *Cyprina humei* — sp. nov. Holotype. North of "Alluvial Working" in Wadi Abu 'Agag and about 11.5 kms. east of Aswan.

Figs. 3a, b, c — *Isocardia aegyptiaca* — sp. nov. Holotype. North of "Alluvial Working" in Wadi Abu 'Agag and about 11.5 kms. east of Aswan.




1
2
3 b
a
b
4 a
1 a b
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3 a b c



SOME PHYSIOLOGICAL ASPECTS OF TOMATO ROTTING IN EGYPT CAUSED BY FUSARIUM AND ALTERNARIA TENUIS (II) FUNGAL COMPETITION IN CULTURE AND ITS BEARING ON MIXED INOCULATIONS OF TOMATO FRUITS

by

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(1) INTRODUCTION

In a preceeding paper (Mostafa & Ezz Eldin 1953), studies have been made on some physiological aspects of Tomato rotting in Egypt caused by *Fusarium semitectum* and Alternaria tenuis — so far as the following points are concerned : (1) The relative growth rates of the two fungi as influenced by the variation of both environmental and physiological factors, (2) The morphological characters, as well as the relative frequency and measurement of spores, of the two fungi at the optimal temperature, (3) The relative susceptibilities of the fruits of the different tomato varieties to the attack of the two fungal competitors, singly and in association, & (4) The qualitative response of the mycelial growth of each individual fungus to its own metabolites on various tomato extracts, and its possible bearing on the relative susceptibilities of different tomato varieties.

In the present paper, complementary cultural experiments will be carried out to elucidate the following aspects of fungal interaction :

(i) The effect of association between mycelia of the two fungal competitors, on agar media, and under varying environmental and physiological conditions, (ii) The effect of association between spores, (iii) The effect of association, between mycelia, in liquid media, (iv) The quantitative response of the mycelial growth of each individual fungus either to its own metabolites or to those of the other fungal competitor, and (v) The possible bearing of the various cultural experiments in interpretating the pathogenicities of the two fungi, singly and in association, to fruits of different tomato varieties.

Since the present paper will be mainly concerned with competition between *Fusarium semitectum* and *Alternaria tenuis*, a short historical review will be firstly given on the nature of inhibition among fungi. Various studies have attributed the inhibitory factor to be due to either one or more of the following : (a) Competition for the available food supply (Millard and Taylor 1927, and Sanford and Broadfoot 1931), (b) Change in the pH value of the medium due to fungal growth (Nikitinsky 1924), (c) Fungal staling products. The chief theories suggest the staling agent to be one of the following substances : (i) Carbon dioxide, formed during respiration (Brown 1923, and Pratt 1924), (ii) Break-down products of complex nitrogenous compounds (Kent 1938), & (iii) Break-down products of complex carbon compounds (Van Luijk 1938-39). Endo (1935) found that certain nitrogenous and carbohydratic compounds favoured the antagonistic action of certain fungi. Advantage has been even taken of these fungal metabolites in controlling certain plant parasites (Darpoux and Faivre Amiot 1950).

Much work has been done to determine the physical properties of the staling substances. Boyle (1924) found that the toxis substance, produced by *Fusarium* sp., was removed by filtration through a 90% collodion membrane and it is partly deactivated by precipitation with alcohol. Allen and Haenseler (1935) found that the toxic substance in *Trichoderma* filtrate was completely inactivated or destroyed by boiling for ten minutes at 100°C. The same effect was brought about by bubbling oxygen through the filtrate for five minutes. Luijk (1938) found that the metabolic products of a *Penicillium* sp. were thermostable. Weindling (1941) stated that the metabolites, produced by either *Gliocladium* or *Trichoderma*, are thermostable. The thermostability was found to decrease with the increase of pH values; in neutral and acid solutions the toxin remains stable for several weeks at room temperature, whereas an increasing alkalinity induces

a high degree of instability. Gupta and Price (1950) found that the metabolic agent, present in the filtrate of *Trichothecium roseum*, is thermostable, non-dialysable, and lyophilizable; its resistance to heat denotes that it is not a protein, while its retention by a cellophane membrane is evidence of its high molecular weight.

With regard to the inter-relationship of fungal interaction in culture and on the host, several investigators have proved a close similarity (Koch 1934, Greaney and Machacek 1935, and Borzini 1938). Other investigators have shown, however, that the interaction in culture might differ from that which takes place in nature (Broadfoot 1933, D'Aeth 1935, and Katser 1939). Mostafa (1948) stated that a correlation could be established if antagonism and compatibility are considered as two interchangeable phases of the same fungal interaction; the balance between the two phases being governed by the existing cultural and seasonal conditions.

(2) MATERIAL AND METHOD

As has been already stated in the first paper, rotted fruits — of various tomato varieties — were brought from different Egyptian localities. The experimental tomato fruits were of three different varieties, namely : Pritchard's, North Dakota, & 1 A B. The two common fungal isolates were identified, through the kind help of the Imperial Mycological Institute, as *Fusarium semitectum* Berk. et Rev. and *Alternaria tenuis* Nees.

(3) MUTUAL GROWTH REACTIONS ON A SOLID MEDIUM

A qualitative study has been made of the growth reaction of each fungus to the association of the other fungal competitor on an agar medium. The fungal interaction has been carried out under the following factors: (a) Temperature, (b) pH value, (c) Nutritive constitution of both synthetic media and natural tomato extracts. Two mycelial discs of the two competing fungi were grown in association in the same Petri-dish; the inoculated discs were more or less equal in diameter, thickness and age.

The mycelial association, between *Fusarium semitectum* and *Alternaria tenuis*, has been carried out on the following agar media : (i) Dox's or glucose peptone at varying temperaturures (Table 1,

Plate 1), (ii) Succinic-phosphate buffered glucose peptone adjusted to different pH values (Plate 11), and (iii) Extracts from red fruits of different tomato varieties (i.e. Pritchard's, North Dakota, and 1A B) at varying temperatures.

(TABLE 1)

Types of mycelial interaction between two growths of either *Fusarium semitectum*, *Alternaria tenuis*, or *Fusarium* plus *Alternaria*, on Dox's agar and on glucose peptone agar, as infuenced by temperature variation; an antagonistic reaction is indicated as "*A*", a compatible one as "C".

Fungus	Agar medium	Temperature			
		10°C	20°C	25°C	30°C
Fusarium semitectum	Dox's	C	C	C	C
	Glucose peptone	*A*	*A*	*A*	*A*
Alternaria tenuis	Dox's	*A*	*A*	*A*	C
	Glucose peptone	C	C	C	C
Fusarium plus *Alternaria*	Dox's	*A*	*A*	*A*	*A*
	Glucose peptone	*A*	*A*	*A*	*A*

The two fungi are antagonistic towards each other on both Dox's agar and glucose peptone at varying temperatures. Similarly, the type of fungal interaction is found to be quite independent of the variation of pH values at the two experimental temperatures (i.e. 10°C and 25°C); it is found to be antagonistic throughout. A distinct line of demarcation exists at the magins of contact.

The results of fungal interaction on extracts of different tomato varieties, at varying temperatures, are also shown (Table 11, Plate 111). Except on Pritchard's tomato extract at 10°C, an antagonistic interaction is maintained throughout, on extracts of different tomato varieties, and under varying experimental temperatures.

(TABLE II)

Types of mycelial interaction between two growths of either *Fusarium*, *Alternaria*, or *Fusarium* plus *Alternaria*, on extracts of different tomato varieties & at varying temperatures; an antagonistic reaction is indicated as "*A*" & a compatible one as "C".

Tomato Variety	Temperature	Two mycelial growths of :		
		Fusarium semitectum	*Alternaria tenuis*	*Fusarium* plus *Alternaria*
Pritchard's	10°C	C	*A*	C
	25°C	C	C	*A*
	30°C	C	C	*A*
North Dakota	10°C	C	*A*	*A*
	25°C	C	*A*	*A*
	30°C	*A*	*A*	*A*
1 A B	10°C	C	*A*	*A*
	25°C	*A*	*A*	*A*
	30°C	*A*	C	*A*

This qualitative test on solid and natural media does not, however, elucidates the following points : (1) The initial stage of interaction between spores, (2) The actual quantitative mycelial growth response of each fungus to its own metabolites or to those of the other fungal competitor, at different stages of fungal interaction, and under varying environmental and physiological conditions, and (3) In antagonistic types of fungal interaction, an inhibition of the free metabolic activity of the slow-growing suppressed fungus — in an early stage — results from the association of the other fast-growing fungal competitor. Accordingly, it was found necessary to carry out the following cultural experiments on liquid media : (a) Interaction between spores, (b) Association between mixed mycelia, and (c) Filtrate experiments concerning the following aspects : (i) Growth responses of *Fusarium* to different treatments of either its own filtrate or to those of *Alternaria*, and (ii) Growth responses of *Alternaria* to different treatments of either its own filtrate or to those of *Fusarium*.

(4) INTERACTION BETWEEN SPORES

The germinative capacities of the conidia of *Fusarium semitectum* and *Alternari tenuis*, singly and in asocsiation, have been tested for on autoclaved extracts of either green or red fruit-extracts of the three tomato varieties. The type of *Fusarium* conidia used are the microconidia, which represents the most dominant type. The mixed spore suspension was prepared by mixing equal volumes of each individual fungal spore suspension. Drop cultures have been made by means of Van Tieghem cells, and the cultures were inculated at 25°C

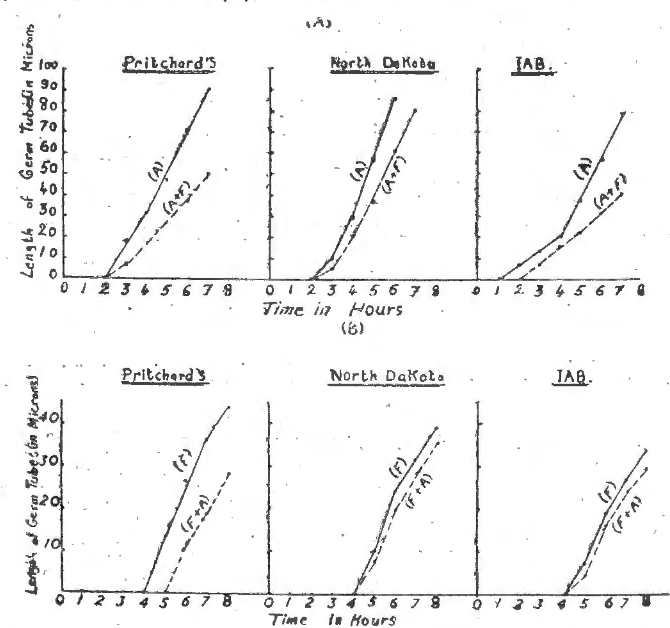
The following criteria have been determined to express germination : (i) Latent period of germination, (ii) Rate of elongation of germ tubes, and (iii) Germination percentage after a regular interval. The length of the germ tubes has been determined by calculating the mean length of 100 germ tubes in each case. The results are expressed both graphically and tabularly (Figs. 1 & 2, Table 111).

(TABLE III)

Germination percentages of conidia of either *Fusarium* alone, *Alternaria* alone, or in association, after 8 hours, on extracts from green & red fruits of the experimental tomato varieties

Tomato	Type of Extract	% germination of conidia of :			
		Fusarium		Alternaria	
		Alone	*Alternaria*	Alone	*Fusarium*
Pritchard's	Green	92	65	76	55
	Red	90	60	78	50
North Dakota	Green	81	72	70	60
	Red	76	70	82	65
1 A B	Green	85	75	80	60
	Red	80	75	85	62

(Fig. 1) The germination of *Fusarium* & *Alternaria* conidia, either singly or in association, on extracts obtained from green fruits of different tomato varieties: (A) *Fusarium* conidia alone (F), or in association with those of *Alternaria* (F + A) & (B) *Alternaria* conidia alone (A), or in association with those of *Fusarium* (A + F).



(Fig. 2) The germination of *Alternaria* & *Fusarium* conidia, either singly or in association, on extracts obtained from red fruits of different tomato varieties: (A) *Alternaria* conidia alone (A), or in association with those of *Fusarium* (A + F), & (B) *Fusarium* conidia alone (F), or in association with those of *Alternaria* (F + A).

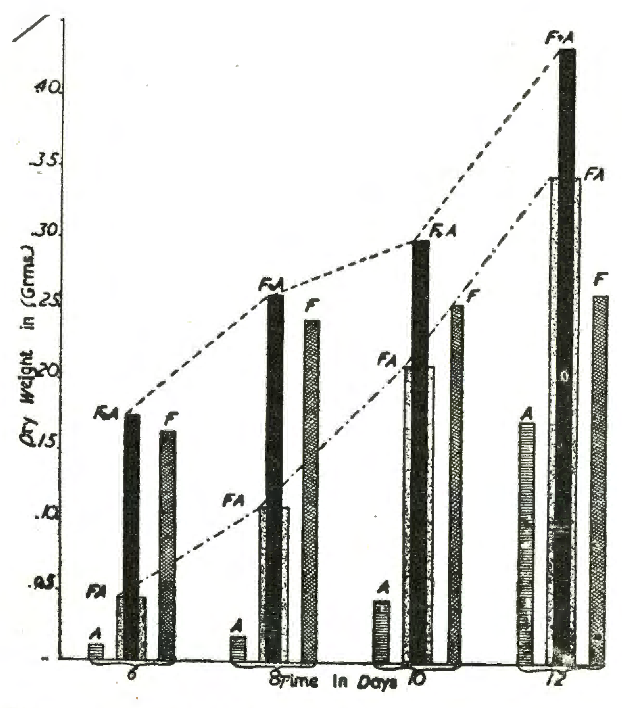
So far as the responses of the germinative capacities of the two competing fungi are concerned, they show similarities with regard to the following aspects : (1) The latent period of germination of the conidia of each individual fungus does not seem to be appreciably influenced by either the stage of fruit maturation or the type of tomato extract, (2) On the green extracts of both Pritchard's and 1 A B tomato extracts, the conidia of the two fungi exert mutual suppressive effect on the germination of one another, and (3) The association of the conidia of the two fungal competitors, on both green and red North Dakota tomato extracts, does not seem to interfere appreciably with the germinative capacities of one another. This seems to be true so far as the latent period of germination, as well as the rate of elongation of germ tubes, are concerned.

The responses of the conidia of the two competing fungi to the presence of one another differ, however, on the red extracts of both Pritchard's and 1 A B tomato extracts. These differences express themselves in two respects : (i) While on red Pritchard's tomato extract the association of *Alternaria* conidia exert a suppressive effect on the rate of elongation of *Fusarium* conidia, no such effect has been shown by *Fusarium* conidia towards those of *Alternaria*, and (ii) While on red 1 A B tomato extract the association of *Fusarium* conidia exerts a suppressive effect on the rate of elongation of germ tubes of *Alternaria* conidia, no such effect has been shown by *Alternaria* conidia towards those of *Fusarium*. The suppressive effect exerted by *Alternaria* conidia on those of *Fusarium* on red Pritchard's extract, and those exerted by *Fusarium* conidia on those of *Alternaria* on red 1 A B extract, have been further emphasized by the observed final decrease in percentage germination of spores.

(5) FUNGAL ASSOCIATION IN LIQUID MEDIA

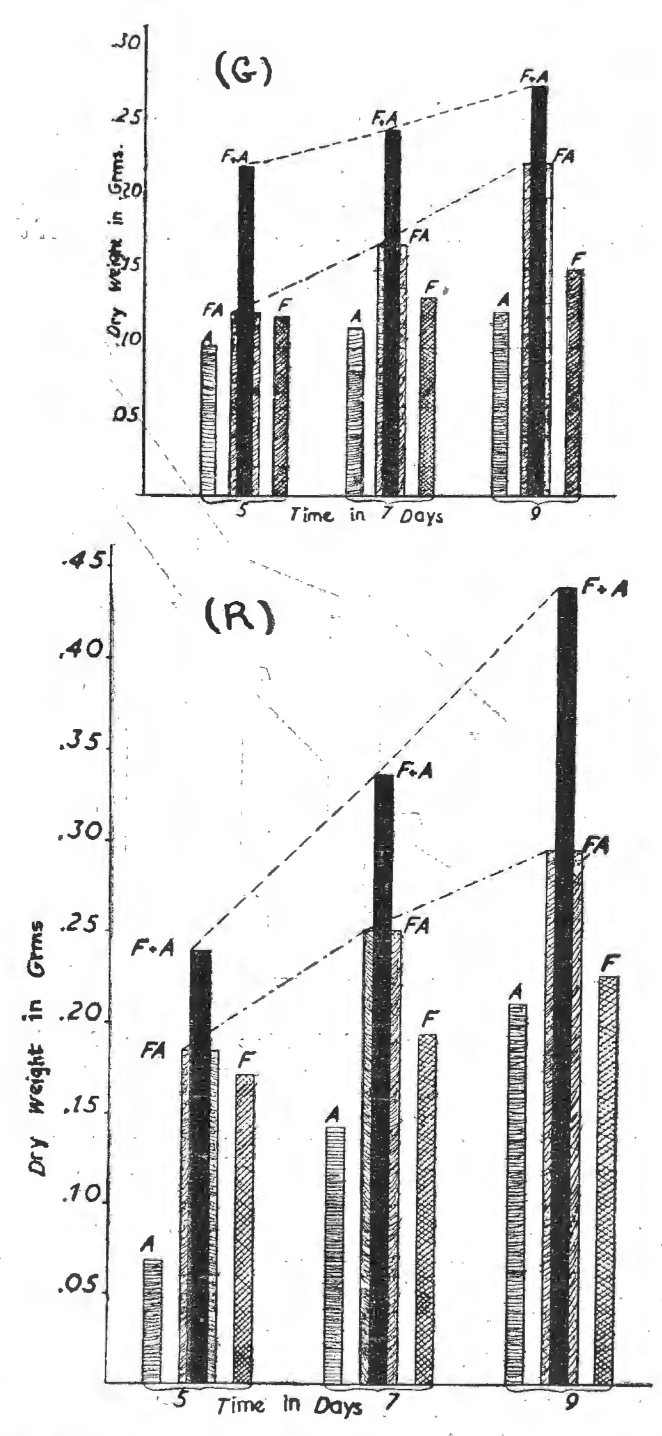
The association between two mycelial growths of *Fusarium semitectum*, of *Alternaria tenuis*, or of *Fusarium* plus *Alternaria*, was made on the following liquid media : (1) Dox's liquid, and (2) Extracts from either green or red fruits of the three tomato varieties. Two mycelial discs were left to compete at 25°C; sets of flasks, of each type, were examined successively at regular intervals. In each case, the mycelial mat was filtered off, washed with water for several times, and dried in an oven kept at 80°C for 48 hours. The dry weight of the mixed mycelium of the two fungi, given per 100 c.cs. of the

liquid medium, was then compared with the sum of individual weights of the two fungal competitors on an equal volume of the medium; the weight was obtained by the addition of the individual mycelial weights of the two fungi, when each is grown separately on 50 c.cs. of the same medium.

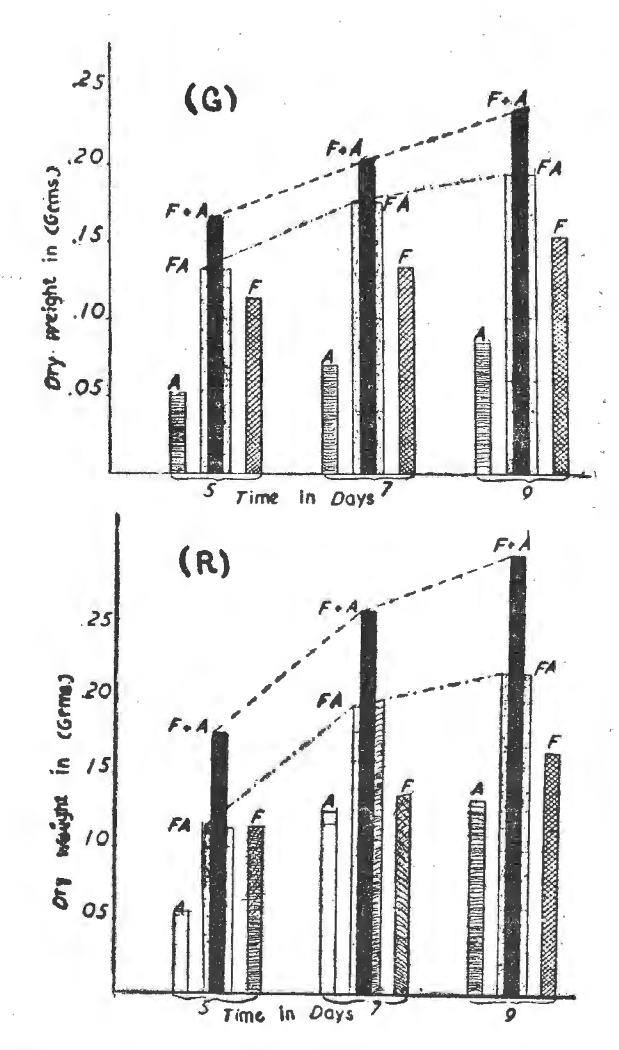


(Fig. 3) Relative mycelial weights of *Fusarium semitectum* (F) and *Alternaria tenuis* (A), singly & in association (FA), on Dox's liquid at 25°C; the sum of invididual weights is indicated as (F + A).

The results of the fungal association in Dox's liquid (Fig. 3), as well as on either green or red fruit-extracts of different tomato varieties (Figs. 4-6), are shown. The relative percentage decreases in mycelial weights, when *Fusarium* and *Alternaria* are grown in association on different green and red tomato extracts, are also represented graphically (Figs. 7 & 8). Concerning the fungal association on Dox's liquid, the following results have been obtained : (*a*) The relative mycelial individual weights of the two fungal competitors are in favour of the greater growth of *Fusarium*, and (*b*) The weight of the mixed mycelium was less than the sum of the individual weights; the percentage decreases in mycelial weights decrease with the increase of the interaction time.



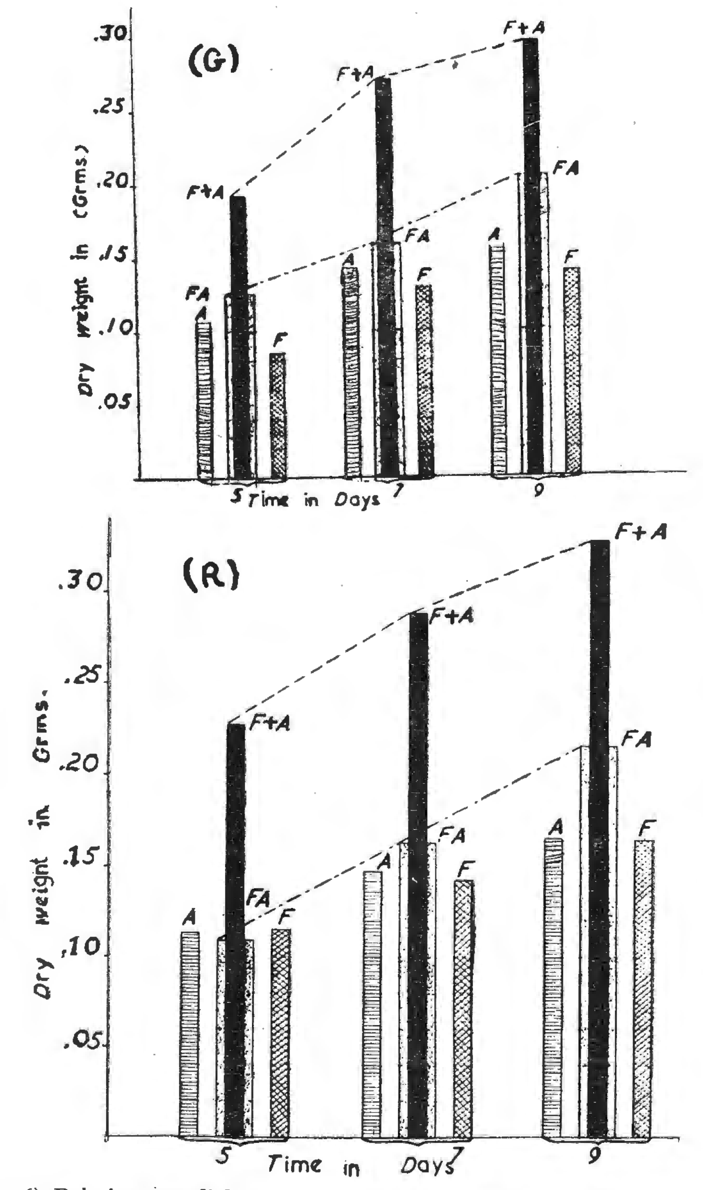
(FIG. 4) Relative mycelial weights of *Fusarium semitectum* (F) and *Alternaria tenuis* (A), singly and in association (FA), on either green (G) or red (R) Pritchard's tomato extract at 25°C; the sum of individual weights is indicated as (F + A).



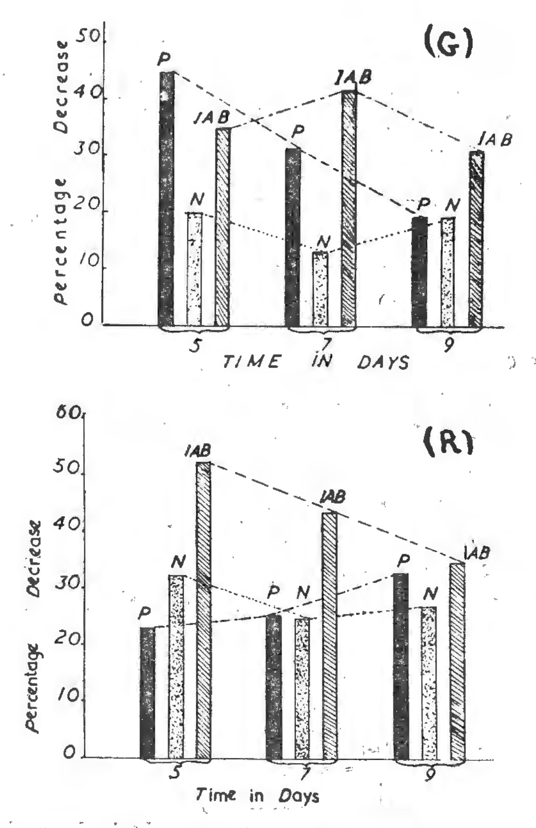
(FIG. 5) Relative mycelial weights of *Fusarium semitectum* (F) and *Alternaria tenuis* (A), singly and in association on either green (G) or red (R) North Dakota tomato at 25° C; the sum of individual weights is indicated as (F+A).

Concerning the mycelial association on different tomato extracts, the following factors have been elucidated in connection with fungal interaction : (i) Nature of tomato variety, and (ii) Stage of fruit maturation. On the different green tomato extracts, except in the fungal interaction after the lapse of five days, the percentage decreases in the weights of the mixed mycelium are greater on 1 A B tomato extract than on those on Pritchard's and North Dakota. The

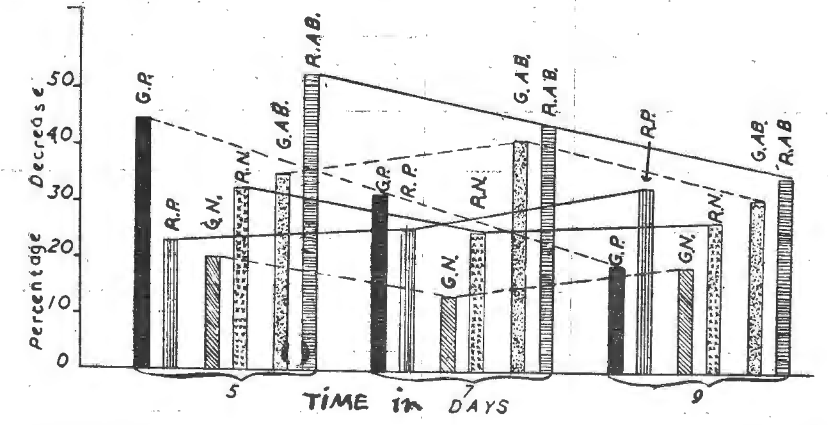
significant decrease in mycelial weight on Pritchard's tomato extract, at the initial stages of mycelial interaction, becomes successively decreased with the increase of the interaction time.



(Fig. 6) Relative mycelial weights of *Fusarium semitectum* (F) and *Alternaria tenuis* (A), singly and in association, on either green (G) or red (R) 1 A B tomato extract at 25°C; the sum of individual weights is indicated as (F + A).



(Fig. 7) Percentage decreases in mycelial weights, when *Fusarium semitectum* and *Alternatia tenuis* are grown in association, on extracts from either green (G) or red (R) fruits of different tomato varieties (i.e. Pritchard's "P", North Kakota "N", & 1 A B).



(Fig. 8) Relative percentage decreases in mycelial weights, when *Fusarium semitectum* & *Alternaria tenuis* are grown in association, on extracts from green and red fruits of different tomato varieties (i.e. green Pritohard's "G.P.", red Pritchard's "R.P.", green North Dakota "G.N.", Red North Lakota "R.N.", green 1 A B "G.A.B." and red 1 A B "R.A.B").

It seems tha the physiological conditions of the 1 A B tomato extract are more suppressive for the two fungal associates. On the extracts from red tomato fruits, the 1 A B variety still keeps its priority to the other two experimental tomato varicties with regard to the greater percentage decreases in the mixed mycelial growths of the two associated fungi at different stages of interaction. There is, however, a significant difference in the course of fungal interaction on red 1 A B tomato variety on the one hand and that of Pritchard's on the other hand. While on 1 A B tomato extract the percentage decreases in the weight of mixed mycelium do not appreciably changed with the increase of the interaction time, there is an increase in the mycelial percentage decreases with the increase of the interaction time on Pritchard's extract.

The pH change could not be considered important in influencing the type of fungal interaction on either the two types of tomato extracts (i.e. green or red). There is, however, a significant difference between the range of pH changes, induced by the fungal growth, on green extracts on the one hand and on red extracts on the other hand (Table IV). The pH changes on the green extracts are more or less restricted within comparatively marrower range (i.e. 5.6 - 8) than those induced on the red extracts (i.e. 4.3 - 9).

(TABLE IV)

The initial pH values of either green or red extracts obtained from fruits of different tomato varieties, & the variations brought about by the growth of either *Fusarium semitectum* & *Alternaria tenuis*, either singly or in association, for ten days at 25°C.

Tomato variety	Type of extract	Initial pH	Final pH after growth of :		
			Fusarium	*Alternaria*	*Fusarium* + *Alternaria*
Pritchard's	Green	5.6	7.5	7.9	7.9
	Red	4.3	8.9	8.9	8.9
North Dakota	Green	5.8	7.6	8	7.8
	Red	4.5	9	9	9
1 A B	Green	6.7	7.5	7.9	7.9
	Red	4.3	8.7	8.8	8.9

(6) FILTRATE EXPERIMENTS

Extracts, from either green or red fruits of the three tomato varieties, were prepared. The filtrate was obtained by growing each fungus in the extract for ten days at 25°C, and the mycelial mat was subsequently removed. The filtrate was then divided into two lots : one lot was steriliz-ed through a seitz-filter, and the other by autoclaving. The seitz-filtration aims at detecting any thermolabile metabolite. Each lot of the fungal filtrate, whether seitz-filtrated or autoclaved, was further subdivided into two portions : the pH value of one portion was left unchanged, and that of the other was restored to the initial pH value of the fresh extract. Thus, for the growth of each individual fungus-on either the green on red extract of each tomato variety — there are the following treatments of filtrates : (*a*) Seitz-treated filtrate, (*b*) Seitz-treated filtrate with pH resotred, (*c*) Autoclaved filtrate, and (*d*) Autoclaved filtrate with pH restored.

The possible rôle of nutritive factor has been also taken into consideration; different treatments of the same filtrate were made by the addition of either water or the fresh extract. Filtrates, from *Fusarium semitectum* and from *Alternaria tenuis*, were obtained from; different green or red fruits. The growth of each fungus was studied on the following treatments of tomato extracts and fungal filtrates : (1) 100% tomato extract, (2) 50% extract plus 50% sterilized water (3) 100% filtrate, (4) 50% filtrate plus 50% extract, and (5) 50% filtrate plus 50% sterilized water.

Four cultures of the same fungus were used for each particular treatment. They were incubated for ten days at 25°C, the mycelial mat was removed, dried at 80°C for 48 hours, and its weight was then determined. The mycelial growth - response of *Fusarium* was tested for different treatments of either its own filtrate or that of *Alternaria*. Similarly, the mycelial growth - response of *Alternaria* was tested for the different treatments of either its own filtrate or that of *Fusarium*. In an attempt to elucidate the nature and physical properties of the fungal metabolites, the following comparisons have been carried out :

(i) Percentage change in mycelial weight compared on (Seitz-treated filtrate plus extract) and on (autoclaved filtrate plus extract); the pH values of both treatments have either left unchanged or restored to the initial pH of the fresh extract.

(ii) Percentage change in mycelial weight on (extract plus Seitz-treated filtrate) in relation to (extract alone) on one hand and in relation to (extract plus water) on the other hand; the pH value of the filtrate was either left unchanged or restored to the initial pH value.

(iii) Percentage change in mycelial weight on (extract plus autoclaved filtrate) in relation to (extract, alone) on one hand and in relation to (extract plus water) on the other hand; the pH value of the filtrate was either left unchanged or restored to the initial pH value.

(iv) Percentage change in mycelial weight compared on (extract plus Seitz-treated filtrate) with its pH left unchanged and on the same treatment with its pH restored.

(TABLE V)

The pH value changes in either *Fusarium* or *Alternaria* Seitz-treated & antoclaved filtrates, & in different treatments of the same filtrate, as a result of the previous growth of each fungus on extracts of either green or red tomato fruits for ten days at 25°C

Tomato variety	Type of extract	Initial pH	Fungus grown :	Final pH: Seitz treated filtrate	Autoclaved filtrate	Seitz treated filtrate + 50% extract	Autoclaved filtrate + 50% extract
Pritchard's	Green	5.6	*Fusarium*	7.5	8.6	7.0	7.8
			Alternaria	7.9	8.6	7.0	7.7
	Red	4.3	*Fusarium*	8.9	10	8.1	8.8
			Alternaria	8.9	9.6	7.9	8.4
North Dakota	Green	5.8	*Fusanium*	7.6	8.5	7.0	7.8
			Alternaria	8.0	9.0	7.3	8.0
	Red	4.5	*Fusarium*	9.0	9.8	7.9	8.7
			Alternaria	9.0	9.5	7.6	8.5
1 A B	Green	5.7	*Fusarium*	7.5	8.5	6.9	7.6
			Alternaria	7.9	8.8	7.2	7.7
	Red	4.3	*Fusarium*	8.7	9.8	7.7	8.5
			Alternaria	8.8	9.6	7.9	8.4

(v) Percentage change in mycelial weight compared on (extract plus autoclaved filtrate) with its pH left unchagned and on the same treatment with its pH restored.

The pH changes due to the previous growth of each fungus on either the green or red extracts of different tomato varieties, as well as those of different treatments of filtrates, have been determined (Table V).

Growth response of Fusarium to its own metabolites and to those of Alternaria.

The growth responses of *Fusarium semitectum* either to its own metabolites or to those of *Alternaria tenuis*, on different green and red tomato extracts, are shown (Tables VI, VII, & X). No detectable *Fusarium* growth has been observed either on the differently-treated filtrates or on the filtrate diluted with water.

Comparisons of the percentage changes in the mycelial weights of *Fusarium*, on different treatments of its (own filtrate plus extract) and on either (extract alone) or (extract plus water), show that the nutritive factor is not the main factor responsible for the inhibition of fungal growth. The previous growth of the fungus, on different tomato extracts, seems to change the pH to a value suppressive for its own development. With regard to the growth response of *Fusarium* to its own metabolic activity, on different green and red tomato extracts, the following results have been obtained : (1) There are significant percentage increases in the mycelial weights on the (extract plus autoclaved filtrate, with pH value left unchanged), compared with a corresponding Seitz-treated filtrate diluted with the same extract. This may indicate the presence of filterable thermolabile inhibitory factor. This factor seems to be more effective in filtrates obtained from green than from red tomato extracts, & (2) On filtrates obtained from green 1 A B, the thermolabile inhibitory factor remains effective at resored pH value. On the other hand, on the other extracts, there are percentage decreases in the mycelial weights of the fungus on the (tomato extract plus autoclaved filtrate, with its pH value restored) compared with a corresponding (Seitz-treated filtrate plus extract). There are two possibilities to account for such a decrease : (*a*) The presence of another thermostable inhibitory factor, which manifests its greater activity at more acidic restored pH values, or (*b*) The presence in the Seitz-treated filtrate of a thermolabile growth-promoting substance, active at restored pH values, and which is destroyed by heating the filtrate during autoclaving. The constant

(TABLE VI)

The dry mycelial weights (in grams) of *Fusarium semitectum* on the different treatments of either its own filtrate or that of *Alternaria tenuis*

Tomato variety	Type of extract	Extract alone	50% extract plus 50% water	Filtrate from:	50 filtrate plus 50% extract					
					Filtrate with pH unchanged			Filtrate with pH restored		
					Seitz-treated	Quto-claved	% increase after auto-claving	Seitz-treated	Auto-claved	% change after autoclaving
Pritchard's	Green	0.0624	0.0149	*Fusarium*	0.0039	0.0136	+	0.0103	0.0054	48% (decrease)
				Alternaria	0.0007	0.0094	+	0.0051	0.0170	+ (increase)
	Red	0.0636	0.0346	*Fusarium*	0.0106	0.0171	+	0.0127	0.0087	32% (deerease)
				Alternaria	0.0005	0.0236	+	0.0081	0.0167	+ (increase)
Morth Dakota	Green	0.0476	0.0245	*Fusarium*	0.0119	0.0237	100%	0.0172	0.0131	24% (decrease)
				Alternaria	0.0091	0.0221	+	0.0167	0.0182	9% (increase)
	Red	0.0552	0.0239	*Fusarium*	0.0115	0.0192	67%	0.0152	0.0111	27% (decrease)
				Alternaria	0.0013	0.0215	+	0.0058	0.0158	+ (increase)
A I B	Green	0.0304	0.0152	*Fusarium*	0.0043	0.0342	+	0.0092	0.0121	32% (increase)
				Alternaria	0.0032	0.0168	+	0.0087	0.0113	30% (increase)
	Red	0.0446	0.0276	*Fusarium*	0.0116	0.0181	56%	0.0137	0.0105	23% (decrease)
				Alternaria	0.0056	0.0205	+	0.0105	0.0196	87% (increase)

(TABLE VII)

Percentage decreases in mycelial weights of Fusarium semitectum on different treatments of either (its own filtrate plus romato extract) or (Alternaria filrrate plus tomato extract), as compared with those on ehe the extract alone or the extract plus water.

Tomato variety	Type of extract	Filtrate from :	In relation to (extract alone)				In relation to (extract plus water)			
			Extract plus Seitz-treated filtrate		Extract plus auto-claved filtrate		Extract plus Seitz-treated filtrate		Extract plus auto-claved filtrate	
			pH changed	pH restored	pH changed	pH restored	pH changed	pH restored	pH changed	pH restored
Pritchard's	Green	*Fusarium*	94	84	78	92	74	31	9	64
		Alternaria	99	92	85	73	95	66	57	14* (increase)
	Red	*Fusarium*	83	80	73	86	69	63	51	75
		Alternaria	99	87	63	72	99	77	32	49
North Dakota	Green	*Fusarium*	75	64	50	73	51	30	3	47
		Alternaria	81	65	54	62	63	32	10	26
	Red	*Fusarium*	79	72	65	80	61	48	35	62
		Alternaria	98	90	61	71	60	80	27	46
I A B	Green	*Fusarium*	86	70	13* (increase)	60	72	39	13* (increase)	20
		Alternaria	89	71	45	63	79	43	9* (increase)	26
	Red	*Fusarium*	74	69	59	76	58	50	34	62
		Alternaria	87	76	54	56	80	62	26	29

* = indicates an increase

percentage mycelial decreases on the extract plus each treatment of filtrate, as compared with either the extract alone or the extract plus water, are rather in favour of the first possibility.

It seems that the auto-metabolic activity of *Fusarium*, on either green or red tomato extracts, results in the production of an inhibitory complex for its own growth. The inhibitory complex may consist of two componets ; (*a*) A thermolabile inhibitory component, filterable through Seitz, and exhibits its greater activity either at neutrabity or at higher alkaline pH values, and (*b*) A thermostable inhibitory component, which may be unfilterable through Seitz, and exhibits its greater activity at rather lower restored pH values. These deductions have been further confirmed by the following observations : (1) The restoration of the pH value of the Seitz-treated filtrate, when added to the tomato extract, causes an increase in the fungal growth. The restored pH value is also more favourable for the fungal growth, and (2) The restoration of the pH value of the autoclaved filtrate, when added to the extract, causes a considerable decrease in the fungal growth. This decrease could not be attributed to the pH changes, since the restored pH value is more favourable for the fungal growth than that induced by the previous fungal growth.

In addition to the possible rôles played by the nutritive and pH factors, the metabolic activity of *Alternaria* — on different tomato extracts — results in the production of a thermolabile Seitz-filterable substance suppressive for *Fusarium* growth. This can be deduced from the constant percentage increases in the mycelial weights of *Fusarium* in (autoclaved *Alternaria* filtrate plus extract) as compared in (Seitz-treated *Alternaria* filtrate plus extract). The substance is found also to be more active at higher pH values than at lower restored pH values. Except on *Alternaria* filtrates from either green Pritchard's or red 1 A B, the restoration of the pH value of the autoclaved filtrate-when added to the extract — causes a significant decrease in *Fusarium* growth. As the restored pH value is more favourable for *Fusarium* growth than that induced by *Alternaria*, we must assume the presence of another thermostable unfilterable inhibitory component more active at restored pH values. There is also the possibility that the stability of the inhibitory factor may increase with the decrease of the pH values; similar observations have been recorded by Weindling (1941).

Growth response of Alternaria to its own metabolites and to those of Fusarium.

The growth responses of *Alternaria tenuis* either to its own metabolites or to those of *Fusarium semitectum*, on different green and red tomato extracts, are shown (Tables VIII, IX, & X). No detectable *Alternaria* growth has been observed either on the differently-treated filtrates or on the filtrate diluted with water.

The results of the growth responses of *Alternaria*, to its own metabolic activity on different tomato extracts, can be summarized as follows : (1) In addition to the nutritive factor and pH change in the filtrate, which tend to suppress the fungal growth, there is a certain metabolic factor responsible for fungal inhibition, (2) Except on pH-restored filtrate obtained from the fungal growth on green North Dakota, the metabolic activity of *Alternaria* — on different green and red tomato extracts — results in the production of a thermolabile filterable substance suppressive for its own growth; there are constant percentage increases in the mycelial weights on autoclaved filtrate plus extract, compared with similar Seitz-treated filtrate plus the same extract, (3) The relative activity of this thermolabile inhibitory substance, as a response to pH value variation, seems to differ according to the experimental tomato extract. On filtrates obtained from green and red 1 A B tomato extracts, the substance seems to be greatly more effective at lower restored pH values. On the other hand, on filtrates obtained from Pritchard's and North Dakota tomato extracts, the thermolabile inhibitory substance is generally more active at higher unchanged pH values, and (4) On filtrates from both green and red 1 A B, as well as from green North Dakota tomato extracts, we must assume the presence of another thermostable unfilterable inhibitory factor — more active at restored pH values — to account for the percentage decrease in mycelial weights observed on restoring the pH values of the autoclaved filtrate.

Similarly, the suppression of *Alternaria* development — as a response to the metabolic activity of *Fusarium* on different tomato extracts — seems to be more correlated with the production of an inhibitory metabolite by the latter fungus. This has been confirmed by the following results : (*a*) There are significant percentage increases in the mycelial weights of *Alternaria* on the tomato extract plus autoclaved *Fusarium* filtrate (with pH left unchanged) compared with a corresponding Seitz-treated filtrate plus the same extract. This indicates the presence—in *Fusarium* filtrate—of a filtrable thermolabile substance suppressive for *Alternaria* growth, (*b*) The relative activity of this substance, as a response to pH value variation, seems to differ

(TABLE VIII)

The dry mycelial weights (in grams) of *Alternaria tenuis* on the different treatments of either its own filtrate or that of *Fusarium semitectum*

Tomato variety	Type of extract	Extract alone	50% extract plus 50% water	Filtrate from :	50% filtrate plus 50% extract					
					Filtrate with pH unchanged			Filtrate with pH restored		
					Seitz-treated	Auto claved	% increase after claving	Seitz-treated	uuto-claved	% changed after autoclaving
Pritchard's	Green	0.0511	0.0352	*Alternaria*	0.0071	0.0153	+	0.0140	0.0354	+ (increase)
				Fusarium	0.0056	0.0141	+	0.0123	0.0100	19% (decrease)
	Red	0.0514	0.0325	*Alternaria*	0.0105	0.0286	+	0.0196	0.0321	63% (increase)
				Fusarium	0.0105	0.0245	+	0.0186	0.0191	3% (increase)
North Dakota	Green	0.0439	0.0221	*Alternaria*	0.0084	0.0273	+	0.0209	0.0180	14% (increase)
				Fusarium	0.0031	0.0217	+	0.0193	0.0163	16% (decrease)
	Red	0.0445	0.0267	*Alternaria*	0.0103	0.0211	+	0.0128	0.0251	96% (increase)
				Fusarium	0.0081	0.0241	+	0.0043	0.0127	+ (increase)
1 A B	Green	0.0406	0.0252	*Alternaria*	0.0232	0.0278	20%	0.0094	0.0201	+ (increase)
				Fusarium	0.0158	0.0238	51%	0.0112	0.0187	67% (increase)
	Red	0.0406	0.0281	*Alternaria*	0.0256	0.0291	14%	0.0106	0.0246	+ (increase)
				Fusarium	0.0105	0.0236	+	0.0095	0.0167	76% (increase)

+ = the percentage increase is more than 100%

(TABLE IX)

Percentage decreases in mycelial weights of *Alternaria tenuis* on different treatments of either (its own filtrate plus tomato extract or (*Fusarium* filtrate plus tomato extract), as compared with those on either the extract alone or the extra;t plus water

Tomato variety	Type of extract	Filtrate from :	In relation to (extract alone)				In relation to (extract plus water)			
			Extract plus Seitz-treated filtrate		Extract plus auto-claved filtrate		Extract plus Seitz-treated filtrate		Extract plus auto-claved filtrate	
			pH changed	pH restored	pH changed	pH restored	pH changed	pH restored	pH changed	pH restored
Pritchard's	Green	*Alternaria*	88	73	70	31	80	60	57	No. change
		Fusarium	89	76	72	80	84	65	60	72
	Red	*Alternaria*	80	64	44	38	68	40	12	No. change
		Fusarium	80	64	52	63	68	43	55	42
North Dakota	Green	*Alternaria*	80	51	36	58	62	5	24* (increase)	19
		Fusarium	93	55	49	62	86	13	2	28
	Red	*Alternaria*	79	71	53	44	61	58	21	6
		Fusarium	82	90	46	71	70	84	10	52
1 A B	Green	*Alternaria*	43	77	32	51	8	63	10*(increase)	2
		Fusarium	61	72	41	53	37	55	6	26
	Red	*Alternaria*	37	74	28	39	9	62	4* (increase)	12
		Fusarium	74	77	42	59	63	66	16	41

x = indicates an increase.

(TABLE X)

Percentage changes in mycelial weights of *Fusarium semitectum* and of *Alternaria tenuis*, each either on (its own Seitz-treated or autoclaved filtrate plus extract) or on a siëilar treatment of the other fungal competitor's filtrate, compared after restoring the pH value of the filtrate to that of the original extract

Tomato variety	Type of extract	Fungus grown :	50% filtrate + 50% extract			
			Fusarium filtrate		*Alternaria* filtrate	
			Seitz-treated	Autoclaved (×decrease)	Seitz-treated	Autoclaved
Pritchard's	Green	*Fusarium*	+	60	+	81 (increase)
		Alternaria	+	29	97 (increase)	+
	Red	*Fusarium*	20 (increase)	49	+	25 (decrease)
		Alternaria	77 (increase)	22	87 (increase)	12 (increase)
North Dakota	Green	*Fusarium*	45 (increase)	45	84 (increase)	18 (decrease)
		Alternaria	+	25	+	34 (decrease)
	Red	*Fusarium*	32 (increase)	42	+	27 (decrease)
		Alternaria	47 (decrease)	47	24 (increase)	19 (increase)
1 A B	Green	*Fusarium*	+	65	+	32 (decrease)
		Alternaria	29 (decrease)	21	60 (increase)	28 (decrease)
	Red	*Fusarium*	18 (increase)	42	87 (increase)	4 (decrease)
		Alternaria	10 (decrease)	29	58 (decrease)	15 (decrease)

+ = The precentage increase is more than 100%

according to the experimental tomato extract. On *Fusarium* filtrates obtained from green and red Pritchard's tomato extracts, as well as from green North Dakota, the inhibitory substance shows its greater activity at higher pH values. On ther othr hand, on filtrates obtained from both green and red 1 A B tomato extracts, as well as from red North Dakota, the reverse condition occurs, and (c) The restoration of the pH value of the autoclaved *Fusarium* filtrate, when added to the extract, causes generally a considerable percentage decreases in *Alternaria* mycelial weights. These decreases could not be attributed to the restoration of the pH values, since the restored pH value is more favourable for *Alternaria* growth than that induced by *Fusarium*. We must assume the presence of another thermostable unfilterable inhibitory factor, which manifests its activity at lower restored pH values.

(7) DISCUSSION

The present discussion will be mainly concerned with the explanation of the various aspects of fungal competitive parasitism in terms of varions cultural studies. An attempt will be also made to find out the relationship between the fungal interaction on tomato fruits and in culture.

The greater susceptibilities of the red fruits to fungal invasion, than those shown by the green fruits from each particular tomato variety, could not be correlated with the initial pH values of both types of fruits, since the initial pH values of the green fruits were more favourable for fungal growth than those of the red ones. It seems, however, that the physiological conditions of green fruits are more stimulating for the greater activity of the inhibitory substance produced by each fungus. This has been confirmed in case of *Fusarium*; the inhibitory factor seems to be more effective, in suppressing the fungal growth, in filtrates obtained from green tomato fruits than from red ones.

The metabolic activities of *Fusarium* and *Alternaria*, when the two fungi are present in association, seem to be mutually suppressive for the growth of one another. This is found to take place independent of the experimental environmental and physiological conditions (i.e. temperature, pH value, and nature of tomato extract). Similarly, in both types of inoculations, the association of *Alternaria* has a depressing effect on the development of *Fusarium* in decayed tomato

lesions. This depressing effect has been further emphasized by the following cultural experiments : (i) The association of *Alternaria* conidia exhibits a suppressive effect on the germinative capacities of *Fusarium* conidia on extracts from Pritchard's tomato variety. This effect is not, however, so significant on red extracts from the other two varieties, and (ii) The metabolic activity of *Alternaria*, on different tomato extracts, results in the production of a thermolabile Seitz-filterable substance suppressive for *Fusarium* growth.

Although a correlation has been successfully established between the associative effect of *Alternaria* on *Fusarium* development both on tomato fruits and in culture, yet no such correlation could be easily established with regard to the associative effect of *Fusarium on Alternaria* development. No result could be actually obtained except on North Dakota tomato fruits, where *Fusarium* has a stimulating effect on *Alternaria* pathogenicity. The failure of detection of any growth - promoting substance in culture may be due to either : (i) The autoclaving of the tomato extract changes the nutritive constitution of the extract in such a way that the fungal metabolic activity differs in culture and on tomato fruits, or (ii) The presence of a growth - inhibitory metabolite may conceal or compensate for the stimulating effect of the growth - promoting substance.

(8) SUMMARY

1. — The present work, as complementary to that carried out in the previous paper, involves the following: (i) Interaction between mixed spores and mycelia, (ii) Quantitative mycelial growth response of each individual fungus either to its own metabolities or to those of the other fungal competitor, and (iii) The inter-relationship of the fungal behaviours in culture and on tomato fruits.

2. — The interaction between spores of the two competing fungi, on different tomato extracts, is found to change with the variation of either the experimental tomato variety or the degree of fruit maturation.

3. — Association between mixed mycelia of *Fusarium semitectum* and *Alternaria tenuis*, on different agar media, has been carried out at varying environmental and physiological conditions; the interaction remains antagonistic throughout.

4. — Fungal interaction on liquid media has yielded the following results : (i) When *Fusarium* and *Alternaria* are grown in association, on different green and red tomato extracts, the weight of the mixed mycelium is constantly less than the sum of individual weights, (ii) The percentage decreases are generally greater on both green and red 1 A B tomato extracts than on similar extracts from the other two varieties.

(5) The results of the filtrate experiments can be summarized as follow :

(*a*) *Fusarium* produces, on green 1 A B tomato extract, a thermolabile inhibitory substance for its own growth. On the other hand, on the other extracts, an inhibitory complex is produced; this consists of a thermolabile Seiz-filterable component and a Seitz-unfilterable thermostable component.

(*b*) The metabolic activity of *Alternaria*, on different tomato extracts, produces generally a thermolabile filterable substance suppressive for *Fusarium* growth. A thermostable inhibitory substance may be also produced in some extracts.

(*c*) The metabolic activity of *Alternaria*, on different tomato extracts, produces generally a thermolabile Seitz-filterable metabolite suppressive for its own growth.

(*d*) *Fusarium* filtrate contains a thermolabile Seitz-filterable substance suppressive for *Alternaria*.

6. — The different aspects of competitive fungal parasitism have been discussed in terms of various cultural experiments.

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EXPLANATION OF PLATES

(Plate 1)

Types of interaction between *Fusarium semitectum* and *Alternaria tenuis* at different:

(1) temperatures, & (II) pH values at 25°C.

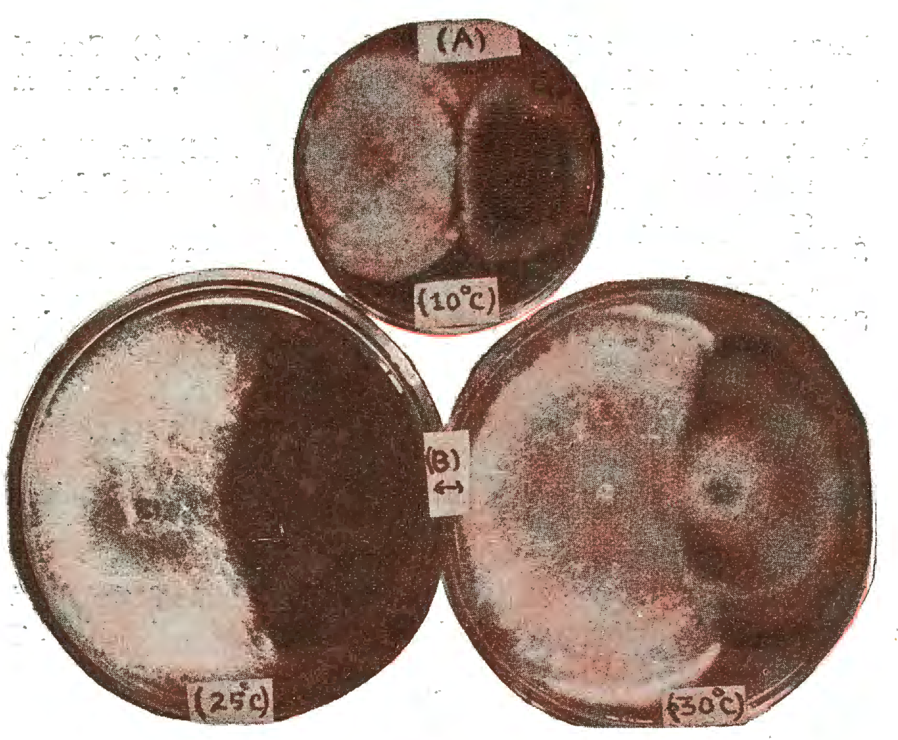
(Plate II)

Types of interaction between *Fusarium semitectum* and *Alternaria tenuis* on tomato extract agar from Pritchard's (P), North Dakota (N.D.) & 1AB varieties at different temperatures.



PLATE I

I



II



PLATE II





Some Contact Features of the Grey Granite N.W. of G. Atud, Eastern Desert of Egypt

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Introduction

During 1951 - 52, the Geological Survey of Egypt mapped a huge mass of grey granite in the districts of "Atud" (°) and "Abu Diab" (°°) in the Central Eastern Desert of Egypt. The mass has a general rounded outline and covers an area of about 180 sq. kms. It is made of grey granite formed essentially of quartz, oligoclase, biotite and hornblende.

The granite mass is rather uniform in composition and is associated with some granodioritic or dioritic patches and some metasediment xenoliths. These are particularly observed in the south-eastern sector of the mass, close to its contact with the metamorphite country. The latter is essentially formed of paraschists, serpentine, talc-carbonate and epidiorite rocks.

(°) Amin, M.S., Sabet, A.H. & Mansour, A.O.S.; Geology of Atud District; Geological Survey, 1953.

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This paper deals with the contact features of the grey granite mass as examined close to Rod Umm el-Farag, between G. Humr Waggat north and G. Umm Huweitat south.

Along the contact zone it is possible to distinguish:

(*a*) the metamorphite country rock zone, (*b*) the porphyroblastic hornblende granulite zone, (*c*) the intermediate zone which merges through (*d*) the granodiorite zone, to the normal grey granite mass.

The distribution of these zones is given in the sketch geological map (fig. 1) and cross-sections (fig. 2) and cross-sections (fig. 3 & 4), and are described in detail below.

These rocks are later on intruded by pink granite and pegmalite dykes whose relations and petrography are described too.

A) *The Metamorphite Country Rock Zone.*

The metamorphite country rock in the area examined is generally made of paraschists, serpentine, talc-carbonate, epidiorite and related rocks. The serpentine, talc-carbonate and epidiorite form small lenticular bodies enclosed in the paraschists and extend parallel to their regional structure.

The paraschists along the contact consist of mica-shist or gneiss and hornblende granulite. The contact of these schistose rocks and granite is marked by development of porphyroblastic rock which makes up a zone of about 300 meters. The mica-schist and gneiss lie further away of the contact zone. They consist of biotite, muscovite, chlorite, quartz, orthoclose and sodic-plagioclase. Schistose and gneissose structures are equally well developed.

The rocks are frequently invaded by quartz and pegmatitic veins and possess a general N - S. schistosity and vertical or steep dip.

The hornblende granulite follows the mica-schist and gneiss towards the granite contact and possesses the same general strike and dip. It is rather schistose, grey coloured rock, and made essentially of fine hornblende grains, plagioclase, and with or without quartz and biotite.

(B) *The Prophyroblastic Hornblende Granulite Zone.*

Towards the granite contact, porphyroblastic rocks are produced. These are made of andesine porphyroblasts in hornblende granulite matrix Usually, the parphyroblasts appear as small grains (3 mms.) alined parall to schistosity, but closer to the granite contact, they become coarser (5-10 mms.) and lose their alinement. The matrix of the porphyroblasts remains same as that of normal hornblende granulite except for the development of some biotite flakes. Some sphene and epidote form accessory minerals in the matrix. The porphyroblasts generally form prismatic crystals with well developed lameller twinning and may enclose grains of hornblende, chlorite and apatite. The porphyroblastic hornblende granulite is frequently intruded by narrow bands of massive granodiorite with sharp contacts, as shown in the cross-section of the porphyroblastic granulite zone diagrammed in (Fig. 3). This demonstrates the mobility of granodiorite mass and its tendency to intrude metamorphites.

(C) *The Intermediate Zone.*

The porphyroblastic granulite zone merges imperceptibly into massive granodioritic and dioritic rocks through the formation of an intermediate zone made of porphyroblastic and foliated granodiorite (Fig. 2) with some dioritic rocks particularly on the western side. The porphyroblastic rocks are continuation of the porphyroblastic zone. The dioritic and granodeoritic rocks in this zone are mostly fine-grained with closely spaced joints, foliated and enclose xenoliths of the metasediments. Their foliation runs parallel to the regional 160°-180° direction.

The xenoliths in this zone are conspicuous. In one example, the metasediment xenolith measures up to 50 meters in length and is made of intercalated mica-hornblende schist or gniess, psammtic bands, granitized schist and contaminated granite (fig. 4). Another huge xenolith is also enclosed in this zone and is made of talc-antigortie rock enclosing kernels of amphibolite, serpentine and seams of chlorite and tremolite.

Generally speaking, the xenoliths in this zone are less granitized than those met with in the following granodiorite zone.

(D) — *Granodiorite Zone.*

The western part of the area examined is made of granodiorite which merges further westwards into the normal grey granite mapped by the Geological Survey in Atud and Abu Diab Districts. It is made of massive rock, light grey in colour, easily weathered and exfoliated, and with well developed widely-spaced joints, especially the cross-joints which run E - W.

The granodiorite is either a fine-grained melanocratic variety or a medium-grained leucocratic variety. Both make up wide areas in the zone and merge gradually into each other. In both, foliation is occasionally developed, (fig. 2), trending in the regional 160° - 180° direction with vertical or steep dip towards west or east.

The granodiorite mass encloses numerous xenoliths particularly observed northwards. They are of dark green colour made of fine-grained quartz-diorite, porphyroblastic hornblende granulite or of biotite-hornblende gneiss. A micrometric mineral analysis of the biotite-hornblende gneiss, is given in table 1, below. The xenoliths vary in length, measuring up to 50 meters and are elongated in the regional 160°-180° direction.

The mass encloses also smaller streaks and lenticular clots of dioritic rock. These are more abundant (not mapped) and measure up to one meter.

The granodiorite mass and dioritic clots or streaks described above are generally made of quartz, plagioclase feldspar (andesine), hornblende, biotite, epidote, sphene and iron oxide. The relative amount of these varies; the ferromagnesian constituents increase in the dioritic clots and melanocratic granodiorite, while the quartz-feldspathic minerals increase towards the leucocratic granodiorite. This can be observed from the following table showing the micrometric mineral analyses of these rocks.

TABLE 1.

Minerals	Hornblende-biotite gneiss xenolith	Dioritic clot	Fine-grained melanocratic granodiorite	Medium-grained leucocratic Granodiorite
Quartz	4	11.5	20.29	27.39
Plagioclase Feldspar	59	58	63.0	51.10
Alkali Feldspar	—	—	5.21	7.0
Hornblende	24	21.3	—	—
Biotite	10	8.5	11.00	12.14
Epidote & Sphene	3	1.0	0.6	2.37

Pink Granite and Pegmatites.

The granodiorite as well as the porphyroblastic rocks are cut by pink granite dykes. These are very frequent in the north-western sector, forming swarms that may extend to 500 mts. in elength. They have consitant trend all over the area (140°-160°) and dip vertically. Their thickness ranges from 5-10 ms.

Petrographically they are composed of quartz and feldspars of fine to medium grains. Orthoclase is the most predominating feldspar, being associated with microcline, perthite and sodic plagioclase. Usually the feldspars are stained with fine haematite dust which gives the rock its pink colour.

The contact of these dykes and the adjacent rocks is not so sharp as compared with the pegmatite veins commonly met in the area. The wall rocks usually acquire a rosy colouration forming a zone of about one meter in width on the sides of the pink granite dykes. The rosy granite is mainly composed of plagioclase feldspar (andesine) and quartz. Orthoclase, microcline and perthite are also fairly represented. The quartz and the alakli feldspars seem to invade the plagioclase feldspar. Biotite is the main ferromagnesium mineral while hornblende, sphene & epidote are accessories. The rosy granite of the contact zone merges gradually to the adjacent granodioritic country rock. A comparison of the mineral composition of the pink granite dykes, the rosy granite walls and the adjacent granodiorite is given in the following table (II

TABLE II.

Minerals	Pink Granite Dyke	Rosy coloured Granite at contact Zone (affected) (Granodiorite)	Adjacent Granodiorite (enclosing the granitic pink dykes)
Quartz	22.0	21.39	18.8
Plagioclase feldspar	65.4	42.63	64.8
Alkali feldspar	11.0	17.65	—
Muscovite	1.0	—	—
Hornblende	—	1.10	3.3
Biotite	—	15.4	9.7
Epidote & Sphene	—	1.9	3.4
Iron Oxide	0.6	—	—

The grandiorites, porphyloblastic rocks and even the pink granite are cut by pegmatitic veins which dominate also in the north-western sector of the area. They are typically coarse-grained pegmatitic rock and formed of quartz, orthoclase, microcline and perthite with some micrographic intergrowths.

The pegmatite veins follow mainly the N. — S. or N.E. — S.W. directions parallel to the cross joints of the granodiorite mass. These veins vary in thickness from 50-100 cms. and may extend for about 100 meters. The pegmatite veins may extend also in a N.W. - S.E direction parallel to the longitudinal joints in the area, but the veins in this case are shorter and thiner.

Pegmatite veins usually posses sharp contacts against the country which distinguish them from the pink granite dykes described above.

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The above described rocks are cut by swarms of dolerite dykes, some granite porphyry and bostonite dykes, which are omitted from the geological map for simplification.

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DISCUSSION

The grey granite mass mapped by the Geological Survey in Atud and Abu Diab Districts, is a huge body with a diameter of about 20 kilometres. In the area examined, this mass developed the following contact features:

1. — Feldspathization of the metamorphites and formation of mica-schist, gniess and porphyroblastic rocks over a zone of about one kilometre.

2. — Marginal foliation of the granodiorite at the contact of the porphyroblastic rocks which does not exceed 200 - 300 meters in the intermediate zone.

3. — Enclosure of some metasediments and serpentine xenoliths on the marginal zone.

4. — Formation of scattered clots of quartz-dioritic rocks.

5. — Formation of melanocratic granodiorites merging into leucocratic granodiorites to the normal oligoclase granite.

These contact features do not exceed 2.5 kms in width which is in fact exceptionally wide in the area examined. Following the contact of grey granite mass, similar features are observed but hardly attain this width.

Apart of these contact features, the granite mass is almost uniform in composition. This indicates that the described features are only local phenomena confined to the margin of the granite mass.

N.M. Shukri and M. Lotfi described similar features in the grey granite mass of Siwigat el-Arsha area - 1954 - (°). They concluded that the "grey granites" are products of the gradual change by replacement (granitization) of hornblendic and pelitic schists and they are largely formed in situ (autochtonous). This explanation is acceptable for the formation of granodiorite-diorite-porphyroblastic rock association described in this article. The evidences of the change are the feldspathization of the metasediments, presence of xenoliths, foliation and the transition of granodiorite-diorite-porphyroblastic rocks.

These rocks, as pointed out before, are localized mainly on the margins of the grey granite mass (Fig. 1.) and therefore is not conceivable to assume that the whole mass of grey granite examined is formed by granitization process in situ (autochtonous). The relative uniformity of the main part of the grey granite body and the uncommon development of foliation, xenoliths and granodiorite in that main part indicate its mobilization. This distinguishes it from the proper autochtonous granitized rocks as those gneisses of Hafafit area previously described by Amin & Afia (1954) (°°) It is admitted that the grey granite hand not attained the mobility of the later pink granite which form dykes and other intrusive bodies within the grey granite mass.

It is concluded that, from a regional point of veiw, the grey granite mass in this area, is of a stage intermediate between autochtonous and allochtonous granites. This stage is measured by the magnitude of the contact features described in this article. The mass can be visualized as produced from a rather homogenous granite

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(°) Shukri, N.M. and Lotfi, M. (1954). The Geology of the North-Western part of Gebel Siwiquat El-Arsha area Eastern Desert of Egypt. Bul. Fac. Sc., Cairo Univ. No. 32.

(°°) Amin, M.S. & Afia M.S. (1954). Anthophyllite-vermiculite deposit of Hafafit, Eastern Desert, Egypt; Econ. Geol. Vol 49 No. 3 page 317.

magma enclosing granitized xenoliths, dioritic and granodioritic relics of the autochtonous granite stage which are particularly common on the contacts.

The formation of the grey granite and related granodiorite, diorite and porphyroblastic rocks is followed by intrusion of pink granite dykes and masses whose formation marks the increase of potash feldspar during later stages of granitization. These are again followed by injection of pegmatites, whose petrography, sharp contact and cross-cutting relation to the pink granite, indicate a late period of formation later than that of pink granite.

FIG. 1.

REGIONAL DISTRIBUTION OF THE GRANITES & METAMORPHITES AND KEY-MAP OF AREA EXAMINED.

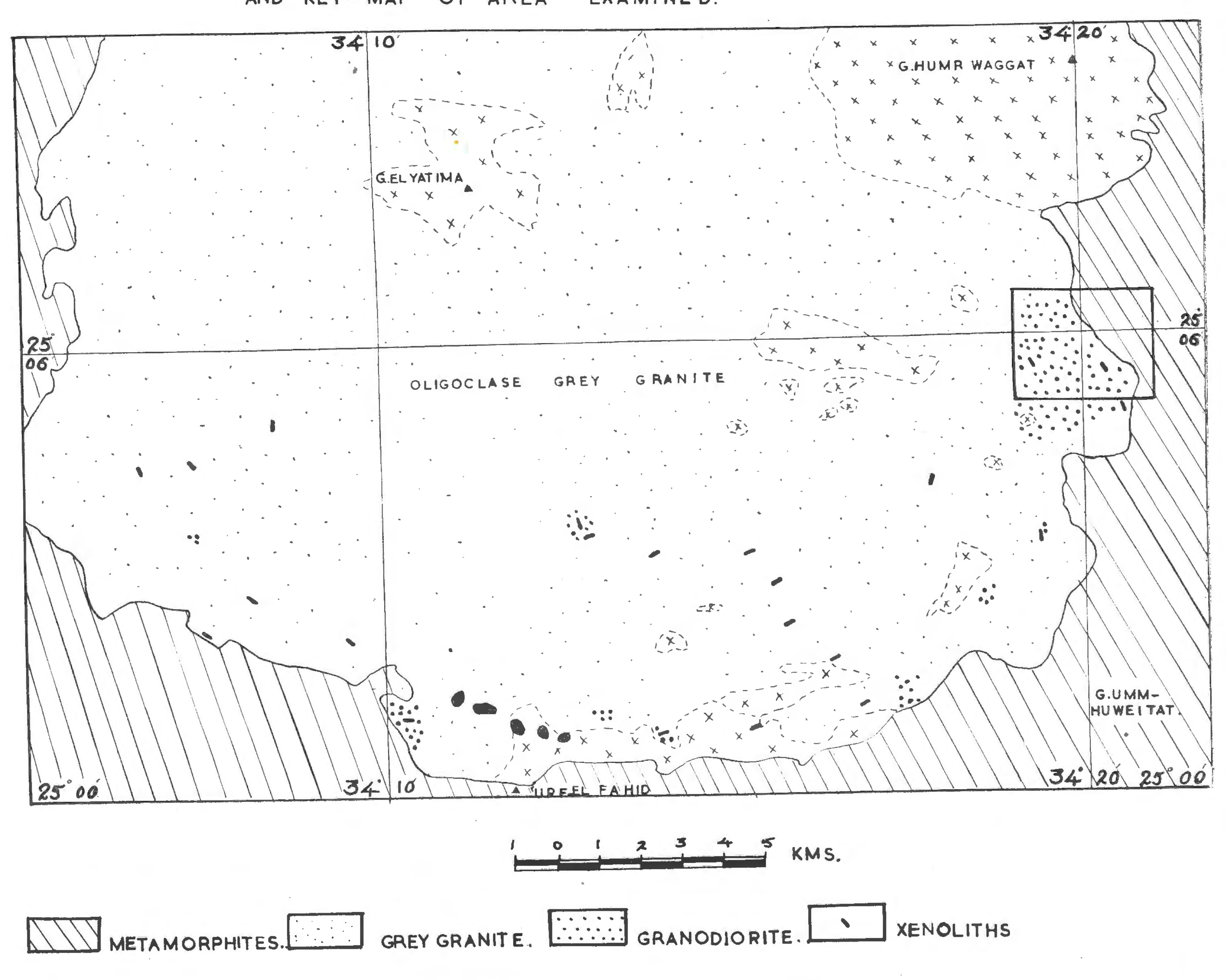


FIG. 2.

34° 19′ 34° 20′ 34° 21′

RECENT GRANITIC SANDS

INTERMEDIATE ZONE

PORPH. HB. GRANULITE ZONE

METAMORPHITE ZONE

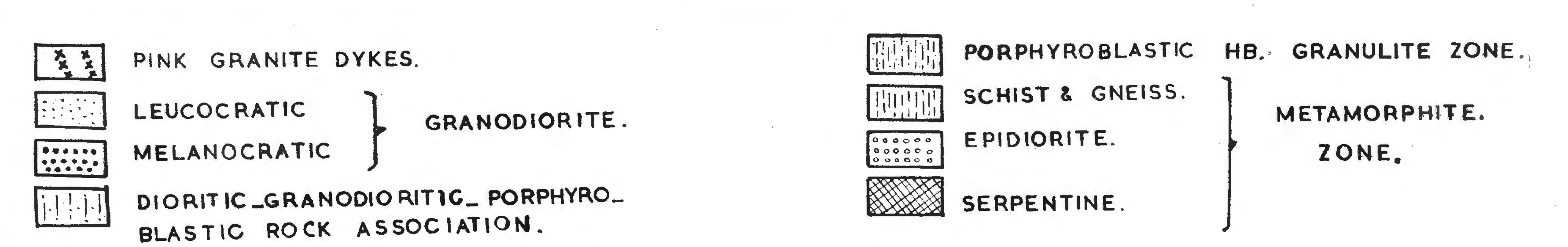
C CC

25° 06′ 25° 05′

34° 20′

100 0 100 200 300 400 500 Mts.

REFERENCE



SCHISTOSITY & FOLIATION.

C XENOLITHS & CLOTS.

PEGMATITIC VEINS.

FIG.3.

CROSS-SECTION THROUGH THE PORPHYROBLASTIC GRANULITE ZONE.

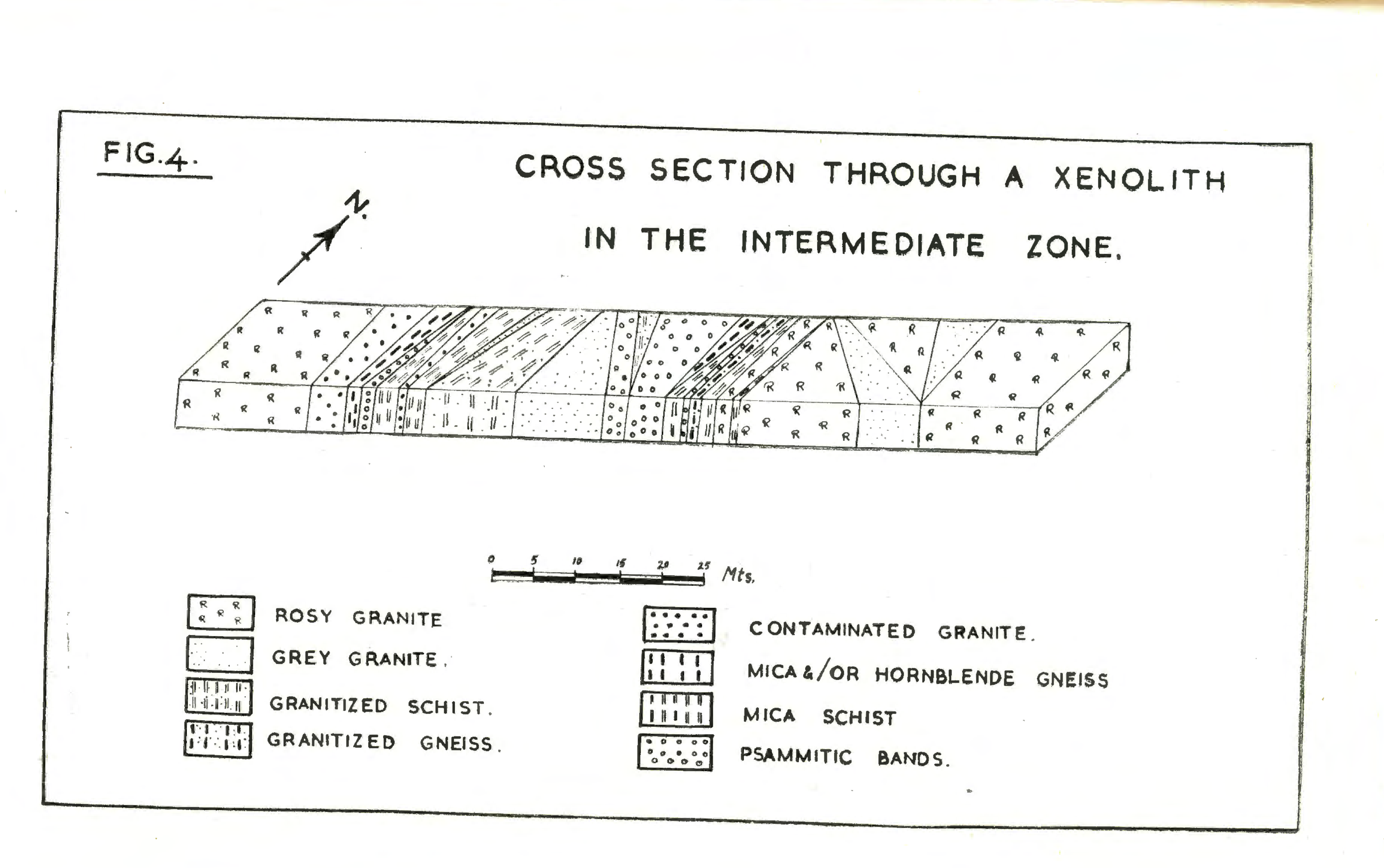
N.

0 0.5 1 Mts

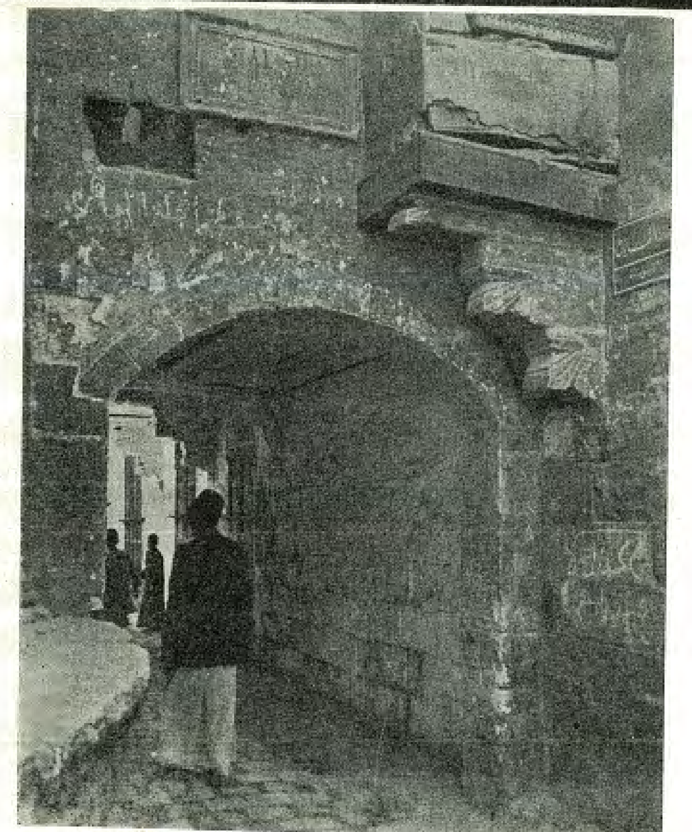
GRANODIORITE BANDS

NON-ORIENTED } PORPHYROBLASTIC HORNBLENDE GRANULITE.

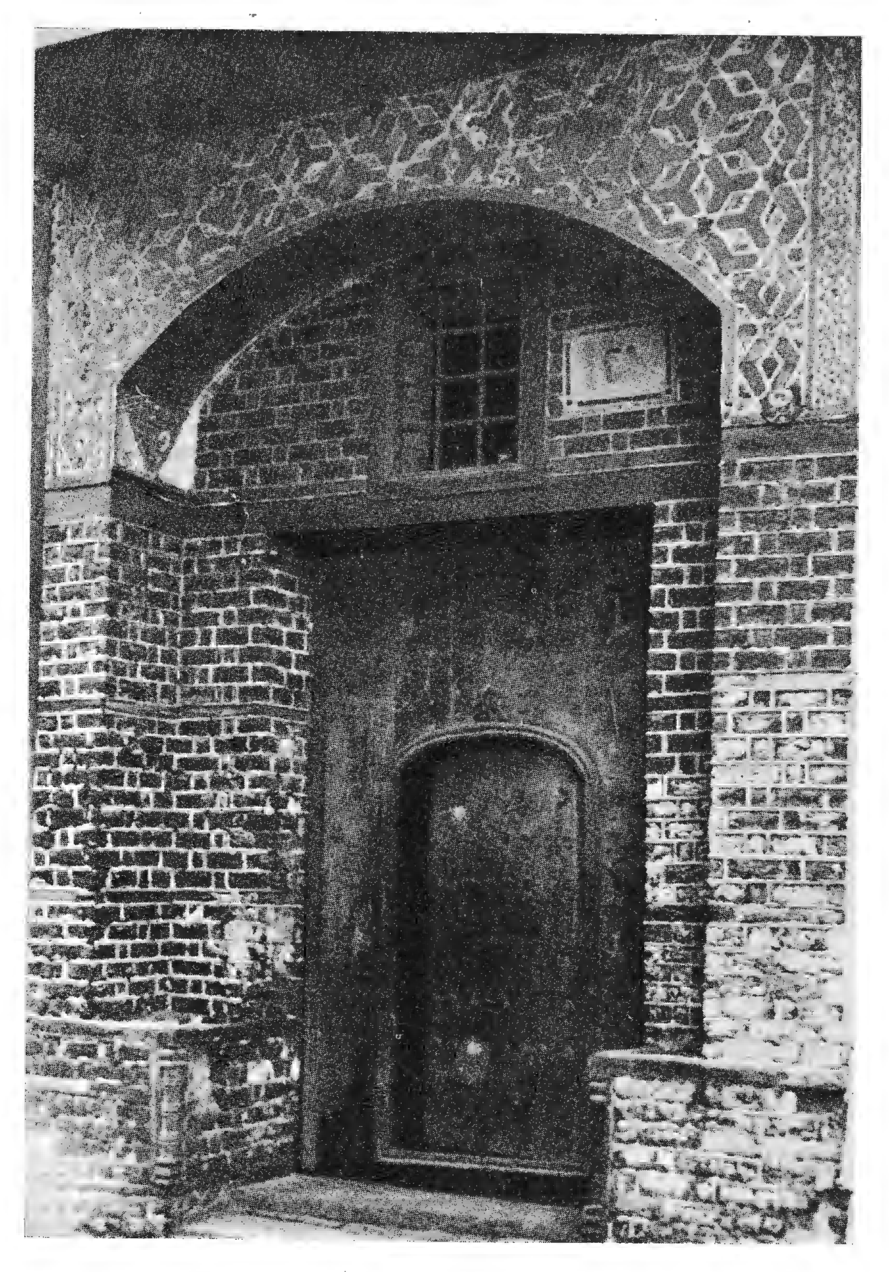
ORIENTED } PORPHYROBLASTIC HORNBLENDE GRANULITE.


FIG.4.
CROSS SECTION THROUGH A XENOLITH
IN THE INTERMEDIATE ZONE.
N.
0 5 10 15 20 25 Mts.
ROSY GRANITE
GREY GRANITE.
GRANITIZED SCHIST.
GRANITIZED GNEISS.
CONTAMINATED GRANITE.
MICA &/OR HORNBLENDE GNEISS
MICA SCHIST
PSAMMITIC BANDS.

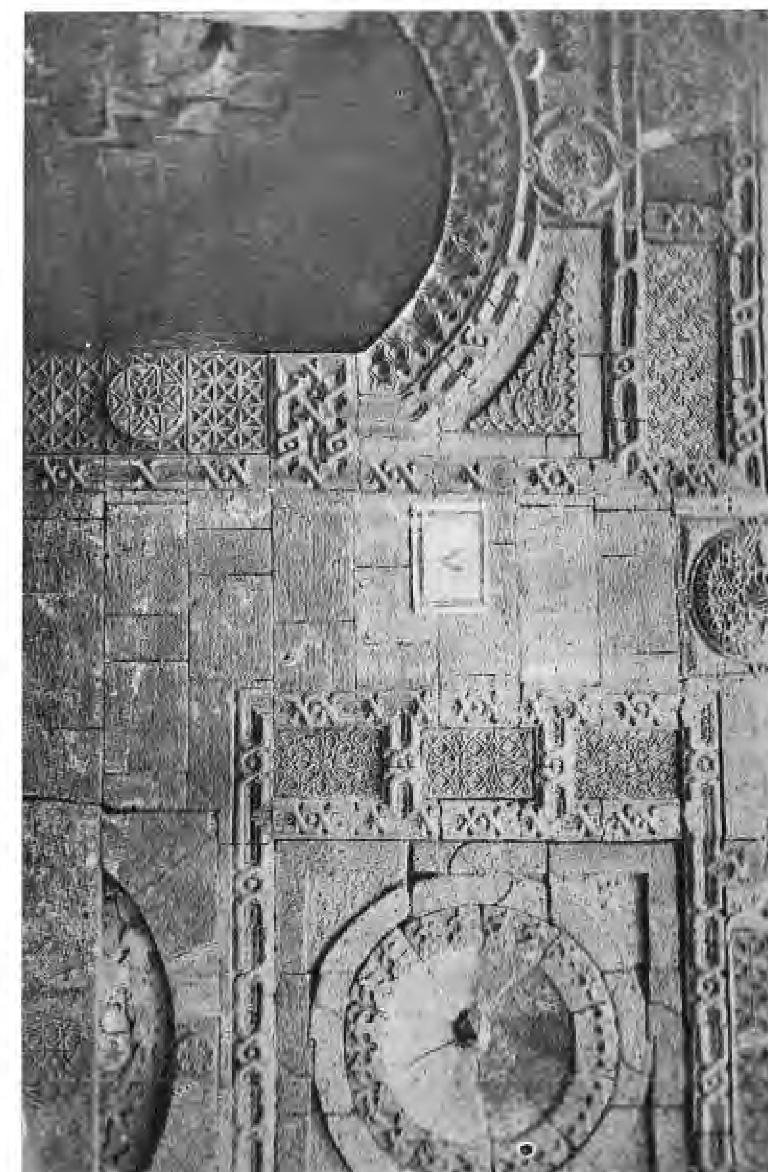




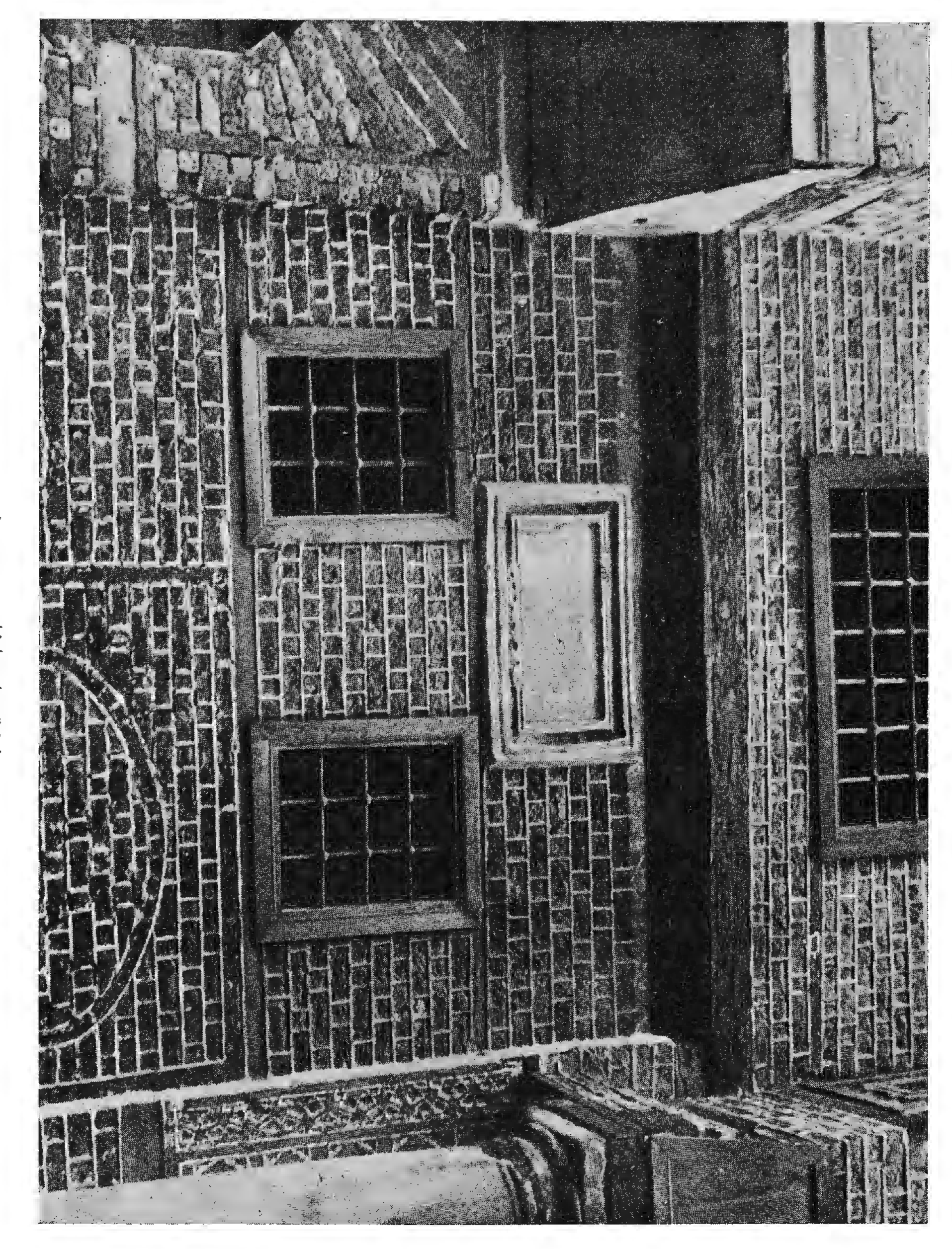
بوابة عطفة الحمام بالسكرية وعليها لافتة باسم العطفة



رقم تنظيم منزل المناديلي الاثرى رشيد



رقم تنظيم المنزل بشارع علوة السمك بمصر القديمة.

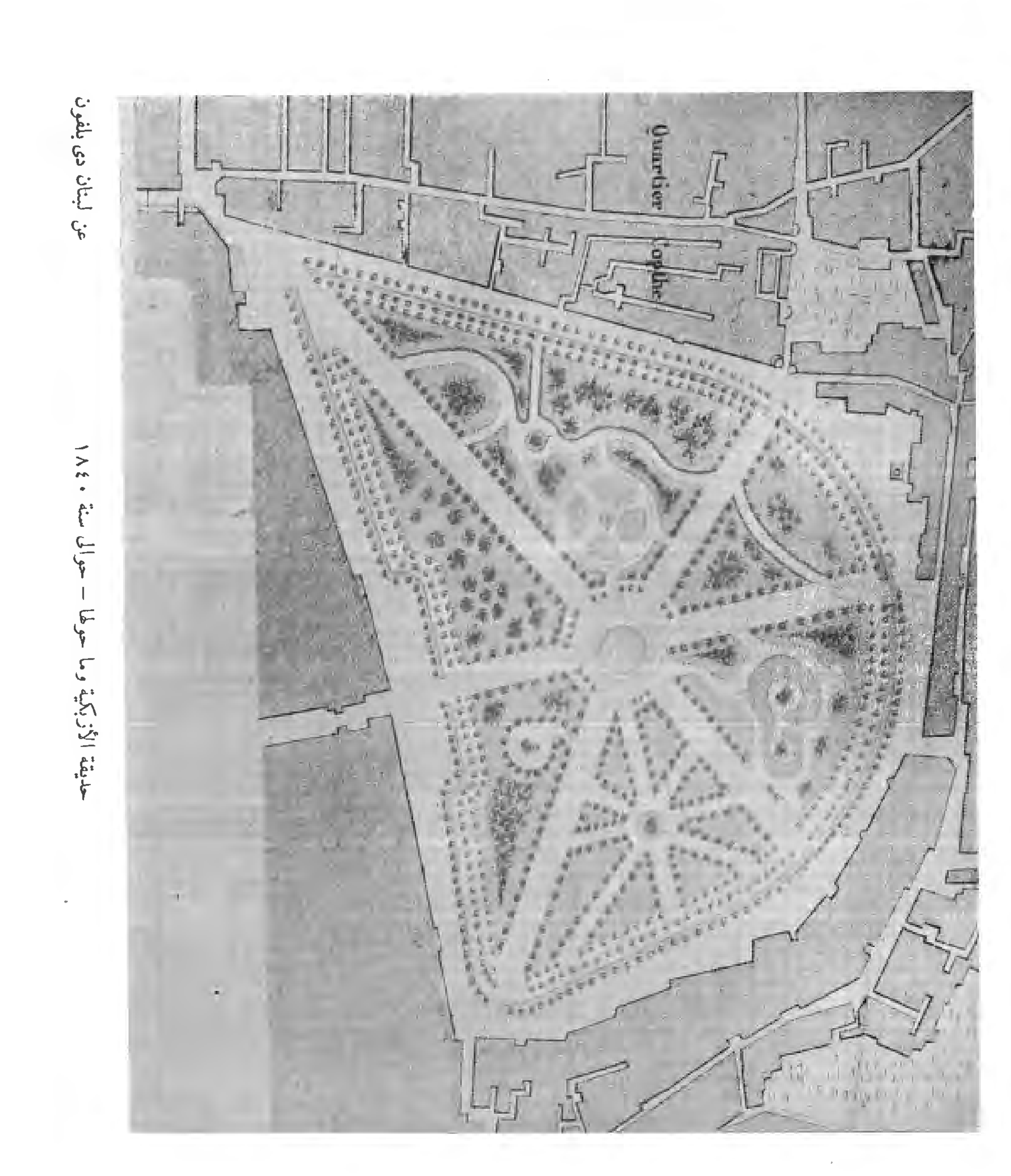


لافتة حارة الحاج يوسف رشيد





لافتات الحوارى . وهذه اللوحة مازالت موجودة عل سبيل السلطان مصطفى بميدان السيدة زينب



حديقة الأزبكية وما حولها – حوالي سنة ١٨٤٠
عن لينان دي بلفون





لافتات الشوارع الرئيسية والفرعية مازالت موجودة على مسجد قراقجة الحسني وعلى سبيل السلطان محمود

بولاق مصر　　　نمرة ٣٣

يوم الثلاث　　　فى غاية ذى القعدة سنة ١٢٤٤

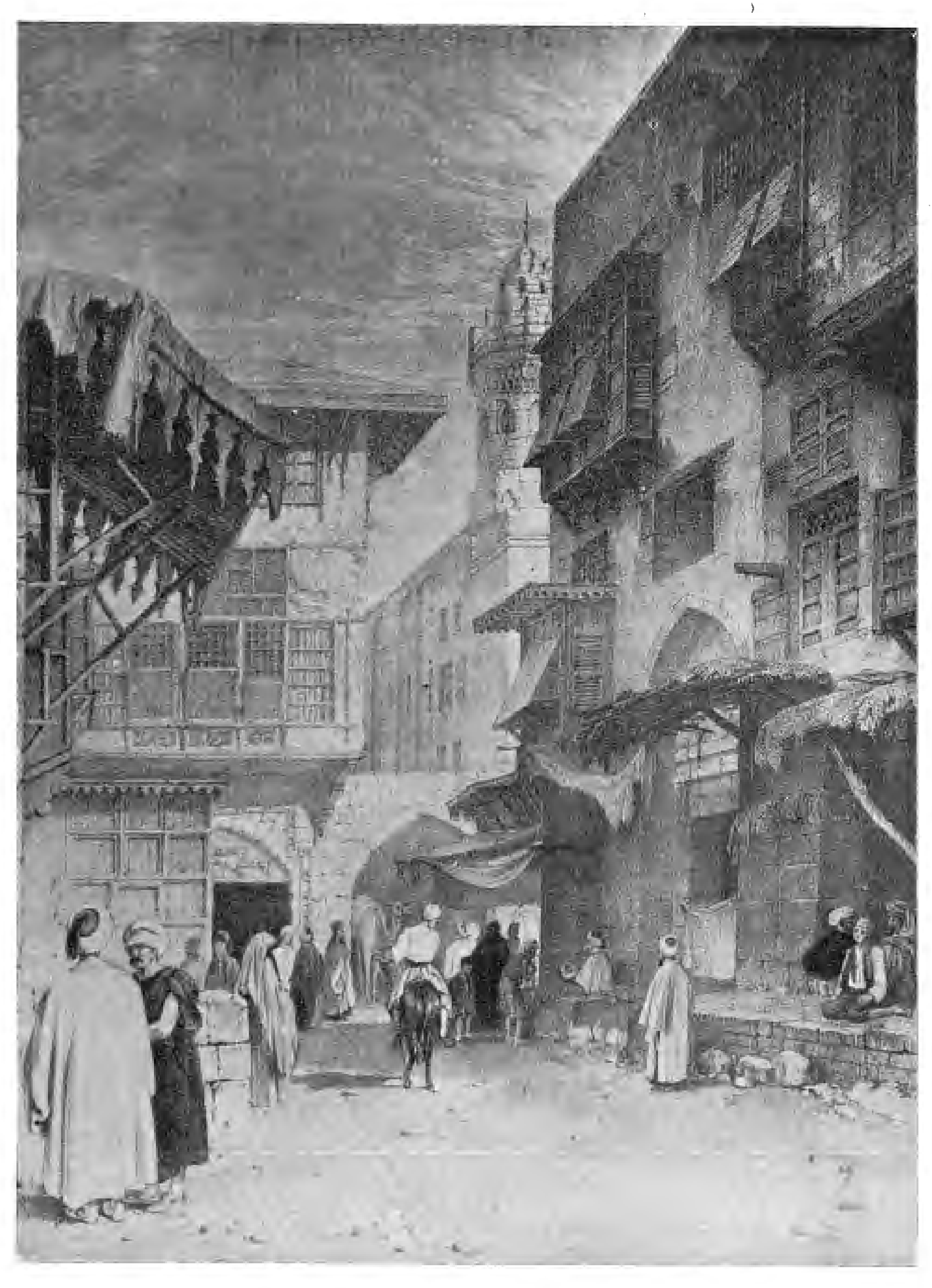
وقايع مصرية

ذا	ايام	درجه	صباح	ظهر	عصر	مغرب	عشا
ميزان هواى مصر							
٢٣	د	درجه	٢١	٢٥	٢٣	٠٠	٠٠
٢٤	هـ	درجه	٢١	٢٦	٢٤	٠٠	٠٠
٢٥	و	درجه	٢٢	٢٦	٢٦	٠٠	٠٠
٢٦	ر	درجه	١٩	٢٧	٢٧	٢٧	٢٦
٢٧	ا	درجه	٢٣	٢٩	٣١	٣٠	٢٩
٢٨	ب	درجه	٢١	٢٧	٢٨	٢٥	٢٤

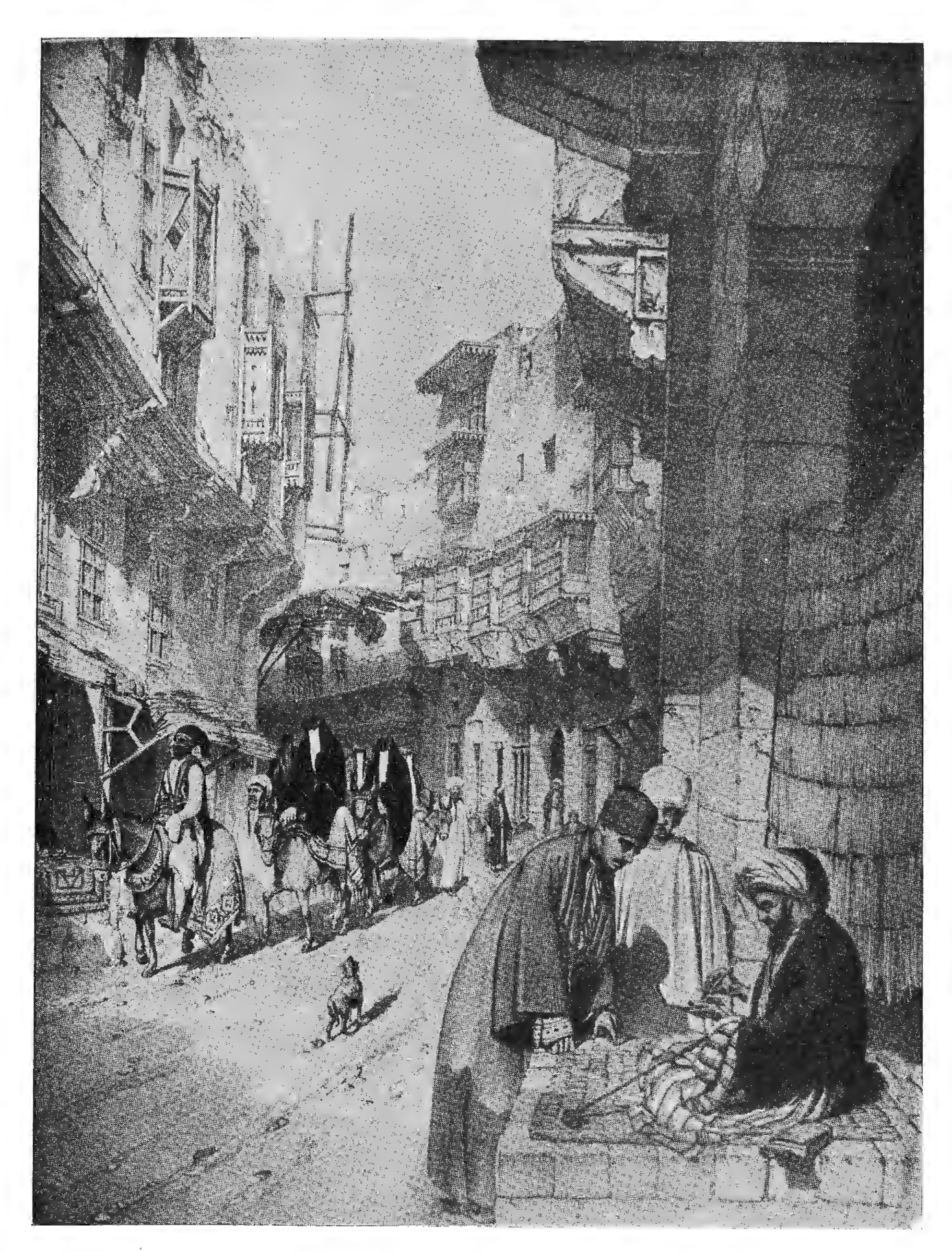
النشرة الجوية الصادرة يوم الثلاثاء آخر ذى القعدة سنة ١٢٤٤ هـ
سنة ١٧٢٨م



شارع شبرا في منتصف القرن التاسع عشر



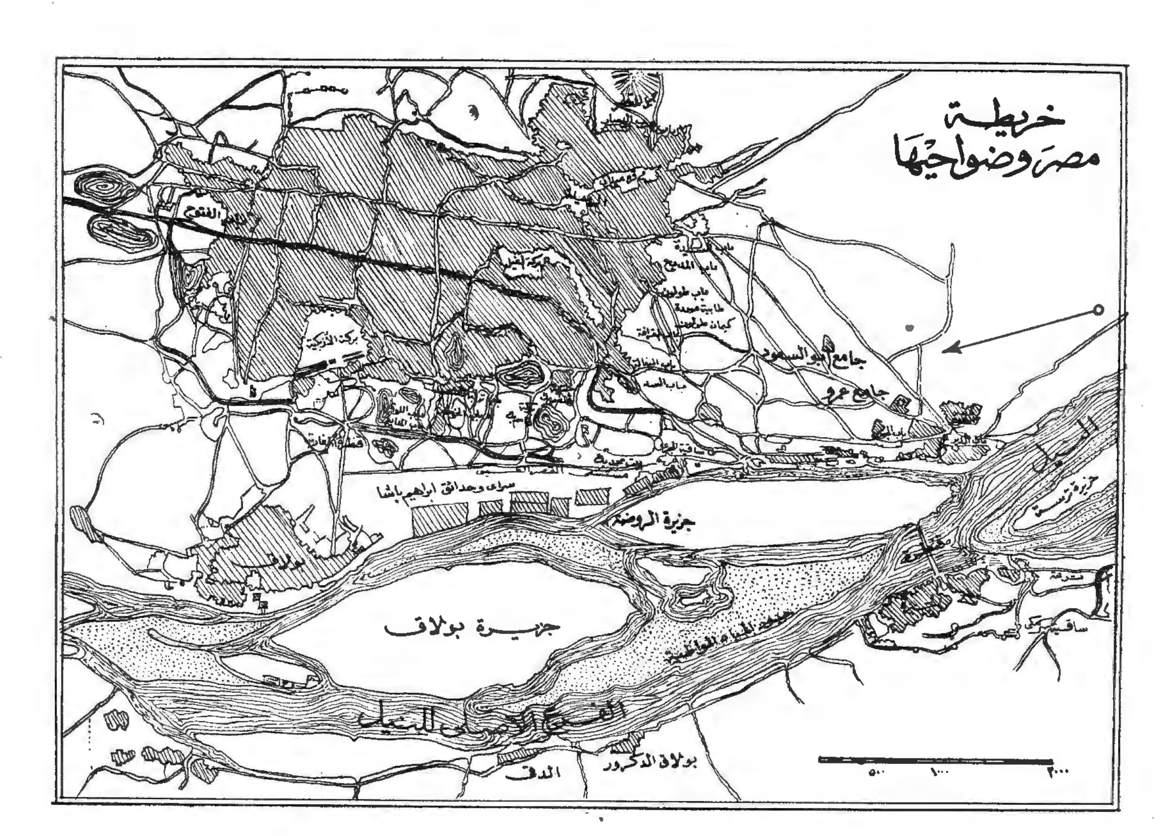
وكالة ذو الفقار وخط الجمالية — القرن التاسع عشر



شارع باب الخلق (القرن التاسع عشر)



بركة الأزبكية فى القرن الثامن عشر



القاهرة فى منتصف القرن التاسع عشر عن كلوت بك



شارع الزيادة بجوار الجامع الطولونى (القاهرة فى القرن الثامن عشر)



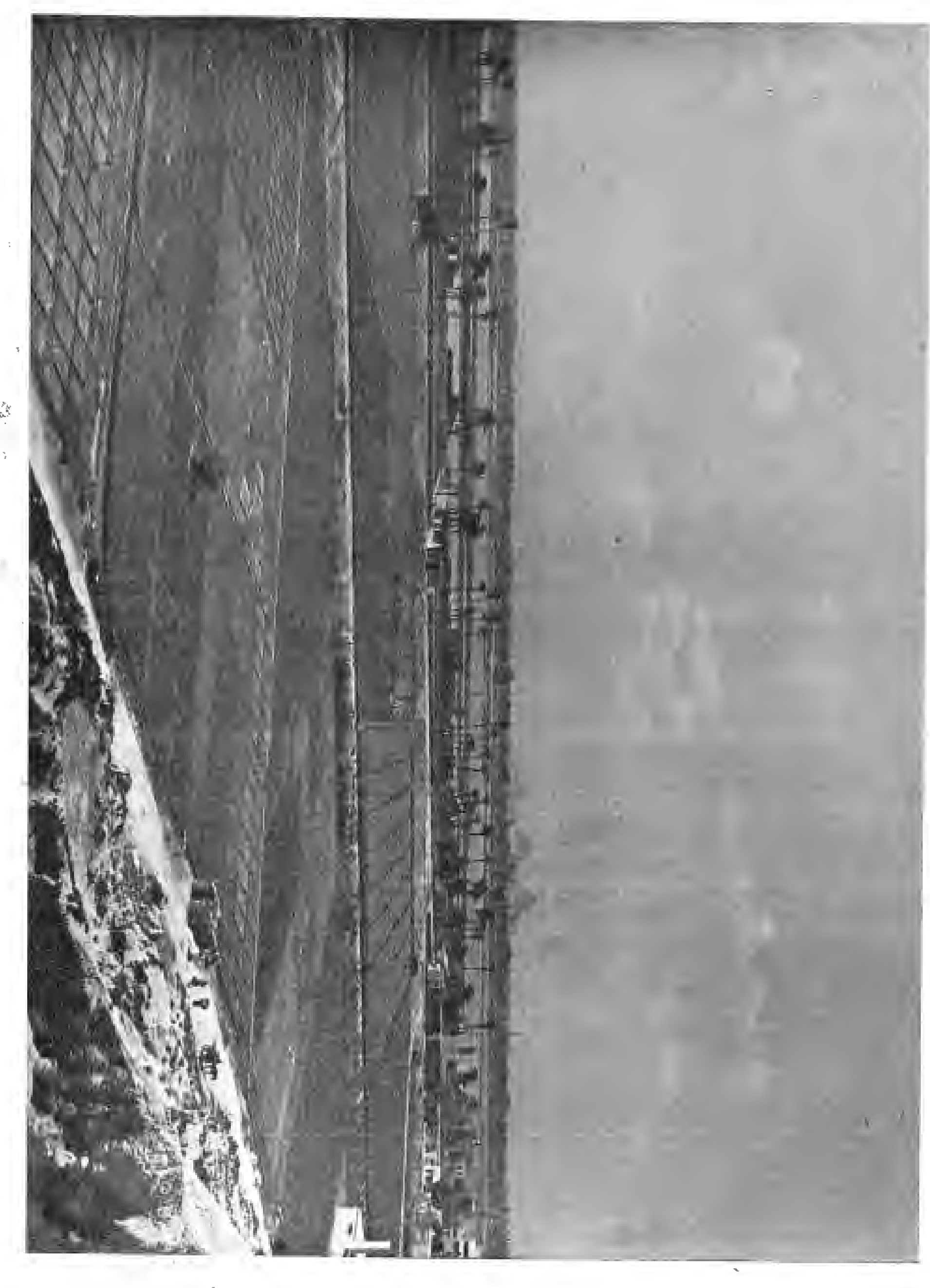
خان الخليلى فى القرن الثامن عشر

LA GRAN CITTA DEL CAIRO

القاهرة سنة ١٥٦٩ — عن براون وهاجنبرج

CARTE TOPOGRAPHIQUE

القاهرة سنة ١٧٥٠ — عن فردون



منظر الجيزة والأهرام مأخوذ من منطقة الرصد التي تمنّى المعز لدين الله تكون بها القاهرة

PLANCHE N° 2

PLAN GÉNÉRAL
DE MAṢR EL-ḲÂHIRAH
sous les Khalifes Faṭimites
(969-1171 de J.C.)

Enceinte de Djauhar 970
" " de Badr el-Djamâli 1087

CANTON D'EL-MAKS

Port d'el-Maks

Khandaḳ el-'Abîd
Ḥârat el-Meimouniyeh
Ḥârat el-Hoseiniyeh
Ḥârat er-Reïḥâniyeh
Bâb el-Foutouḥ
Bâb en-Naṣr
Ḥârat el-Farḥiyeh
Ḥârat Berdjouân
Bâb el-Kanṭarah
Ḥârat er-Roûm el-Oulyâ
el-Minḥar
Jardin de Kâfour
Petit Palais de l'Ouest
Place de Bain el-Ḳaṣrein
Grand Palais de l'Est
Ḥârat el Outoufiyeh
Place
Ḥârat Kâfûl el-Kouwwad
Khalîdj el-Ḥâkimî
Bâb el-Faradj
Ḥârat el-Wezîriyeh
Ḥârat el-Oumarâ
Ḥârat el-Bâṭiliyeh
Ḥârat el-Djoudariyeh
Mosquée el-Achraf
Ḥârat ed-Dailam
Mosquée el-Azhar (970)
Ḥârat el-Maḥmoûdiyeh
Bâb Sa'âdah
Mosquée & Tombeau de S. Ghouri (1503)
Ḥârat el-Atrâk
Ḥârat Zouwaileh
Mosquée de Ḍâhir
Ḥârat er-Roûm es-Sofla
Ḥârat Kitâmah
Bâb el-Barḳiyeh
Ḥârat el-Bâṭiliyeh
Mosquée d'el-Mouayyad
Bâb Zouwaileh el-Djadîd
Ḥârat Sibawaih Tawârik
Ḥârat el-Masâmidah
el-Charâbiyeh
Ḥârat el-Yânisiyeh
Bâb el-Maḥroûk
Ḥârat el-Maḥroûk
Canal du Caire
Banlieue du Caire (ed-Dawâhi)
Etang de l'Eléphant
Echelle : 13,125
0 100 200 300 400 500 600 700 800 900 1000 1100

Gravé par L. Simon, 15, rue du Val-de-Grâce – Paris
Imp. Monrocq – Paris

القاهرة الفاطمية والميادين حول القصرين الفاطميين   عن رافيس

وكان يشرف على البركة حى الأقبـاط المعروف الآن بحارة النصارى . وكانت دوره كبقية دور القـاهرة حافلة بالمشربيات والشبابيك الخرط . وهو الطراز السائد لأحياء القاهرة .

ومن الدور التى كانت تشرف على البركة وأبيحت حدائقهـا للجمهور . دار السيد ابراهيم بن السيد سعودى . وكانت من الدور الكبيرة التى عنى بتشييدها وصرف عليها مبالغ كبيرة . أباح حدائقها المتاخمة لبركة الأزبكية لعـامة [1] الناس يتنزهون فيها .

وهذه الدار هى التى آلت إلى الأمير محمد بك الألفى سنة ١٧٩٦ م فهدمها وتغالى فى بنائها . ولم يسكن بها سوى أياماً حتى وقع الاعتداء الفرنسى الممقوت فاغتصبها الفرنسيون وأقام بها سارى عسكر بونابرت ثم الجنرال كليبر . وبها قتل .

ومن تلك الدور دار الشرايبى ، وكانت على الحافة الشرقية للبركة . وهى إحدى دور المجد ، ألحقت بها مكتبة قيمة حفلت بكتب العلم فى مختلف الفنون . عرضت للجمهور على الطريقة الحديثة . فيدخل الطالب فيختار ما يحلو له ليطالعه فى المكتبة أو يستعيره خارجها [2] .

وقد تنقلت ملكية هذه الدار حتى آلت إلى الأمير رضوان كتخدا الجلفى فأدخل عليها تعديلات ، ووسع حدائقها وأباحهـا [3] للنزهة وخاصة أيام فيضان النيل . ثم آلت إلى طاهر باشا ناظر الجمارك ثم عباس باشا الأول فهدمها وأعاد بناءها . ومنـذ ذلك الوقت أطلق على تلك المنطقة اسم العتبة الخضراء بدلا من [4] العتبة الزرقاء . ومحلها الآن الحديقة وسط ميدان العتبة الخضراء .

وكانت مدرسة الألسن على البركة ، ثم حولت إلى فنـدق للإنجليز عرف فيما بعد بفندق شبرد .

وفى منتصف القرن التاسع عشر ردم أكبر قسم من البركة فأزيلت الكيمان التى كانت مجاورة لها وأقيمت المتنزهات وشيدت المنتديات .

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(١) عجائب الآثار للجبرتى ج ٣ ص ٢٤٣ .
(٢) عجائب الآثار للجبرتى ج ١ ص ٢٠٤ .
(٣) عجائب الآثار للجبرتى ج ١ ص ١٩٢ .
(٤) عبر البشر فى القرن الثالث عشر ص ٤٨ خط .

وفى سنة ١٨٦٤ م ردم البركة وضمت إلى الحديقـة التى أعيد تنظيمها . وأقيمت بها البرك والأكشاك والجبلاية ووضعت بهـا [1] الطيور المغردة ، وأضيئت بغاز الاستصباح ، وشقت بها الشوارع حسب تخطيطها الحـالى . وأنشىء بجوارها ثانى مسرح كوميدى . ثم أنشئت دار الأوبرا سنة ١٨٦٩ م .

وفى سنة ١٨٩٩ م تم إنشاء فندق الكونتننتال واحتفل بافتتاحه .

وفى ٢٧ أبريل سنة ١٩٥٤ شقها شارع ٢٦ يوليه ذلك الشارع العظيم مضرب الأمثال فى سرعة التنفيذ ، وفتحت أبوابها للشعب ينعم بها ففرجت كرب الفقراء المحيطين بها وتنفسوا هواء نقيا استخلص الحمد والدعاء الخالص بدوام التوفيق للقائمين بهذا العمل الجليل .

وكذلك أباح الكثير من أغنياء مصر حدائق دورهم لجيرانهم ينعمون بالتنزه فيهـا . وكانت حدائق الدور الكبيرة وسط أحياء القـاهرة بمثابة حدائق عامة تنفس بسعتها عن سكان الحى .

وممن أباح حديقة قصره وعلى نطاق واسع الأمير قاسم بك أبو سيف المتوفى سنة ١٢١٦ هـ — ١٨٠١ م . فقد كان قصره يشغل مساحة كبيرة من أراضى البركة الناصرية ، يحيط به حديقة كبيرة تشقها قنوات الماء التى تصل إلى البركة أيام فيضان النيل ، وأحكم جريان الماء فى قنوات مرتفعة ، وغرس فيها الزهور والفواكه والنخيل والأشجار [2] .

ونسق بها جلسات مفروشة لخاصته ظللها بالزهور ، وأباح للناس الدخول إليها ، والتنزه فى رياضها ووضع لافتة على أحد الأشجار بمدخلها كتب عليها : (حديقة الصفصاف والآس ، لمن يريد الحظ والائتناس) .

حسن عبد الوهاب

كبير مفتشى الآثار الإسلامية

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(١) المحاسن البهية فى حديقة الأزبكية ص ٥ — ٧ .
(٢) عجائب الآثار للجبرتى ج ٣ ص ٢١٩ .

الحسان ، وجسم جمال النقش يكاد أن يتحرك بروح حسنه وعروقه اللاعبة .

وتظن رخامها الملون فى حسنه من زهر الرياض ، وأسوده فى أبيضه كسواد العيون منها فى البياض .

ثم وصف الحمامات بقوله : يالها من حمامات يستوقف النواظر حسن رخامها الوسيم ، ويستوقف الأسماع صوت مائها الرخيم ؛ وتحير فى حسن بهجتها النظار ، إذا أشرفت أقمار جاماتها بالنهار » .

ثم وصف البركة بقوله « انها بركة محفوفة بالمفترجات والمناظر ، ترتاح إليها ، النفوس وتقر بها النواظر ، فهى بركة أنيقة المنظر ، صافية المخبر ، أرضها كالعنبر وعرفها كالمسك الأذفر .

ثم تدرج إلى وصف الحدائق حولها ، وما يقام بها من حفلات بوصف لايدع مجالا للشك فى استعمال الألعاب النارية فى هذا الوقت ، فيقول :

كانى أراها حين سعى الناس إليها من كل مكان فى ليلة أحرقت مردة الهموم ، بشهب من نيران النفط كالنجوم الرجوم ، فبينما الناس فى لهو وفرح ، وبسط من الأنس ومرح إذ أطلع فلك سماء الماء فلكاً تحمل أشجاراً من نار ، يقذف النفط منها أنواعاً من الأزهار ، من مفضض ومذهب ومدبج من ألوان اللهب ، وأسهم تنسب مع إصابتها إلى الخطأ ، وضوء شمس يكشف عن وجه الظلام الغطا فى ليلة ينجاب عن وجهها الظلام ، وشاهد الناس فيها العجب ، لما اصطلح الماء مع اللهب ؛ وطار على وجه الماء فراس من ذهب ، ودارت بأكف اللاعبين دواليب من نار ، من غير رياش تدور على قلب ولا زنار ؛ فيالها من نار أثلجت الخواطر ، وأقرت برؤيتها من الحاضرين كل ناظر .

ولاشك فى أن هذا وصفاً صادقاً للألعاب النارية التى عرفتها مصر منذ أربعة قرون ونصف .

ثم استطرد فى وصف البركة فقال : « فيالها من بركة ماؤها بتجعيد الرياح كالمبرد يجلو عن القلوب الصدأ ، افتخرت سماء مائها ، بكواكب أسماكها ؛ وإن افتخرت بشموسها وبدورها ، افتخرت بشموس حسانها وبدورها ، فهى فى زمن النيل بمناظرها كالسماء ذات البروج ، وفى زمن الخريف ذات

شطوط ومروج ؛ فاذا نضب عنها الماء خرج من سجن طينها من زغب الحب ماكان من المحابيس ، وبرزت فى حلل من زهر الربيع كأذناب الطواويس ؛ يالها من بركة إذا رآها الناظر أعلن بالتهليل والتكبير ، ودعا بطول البقاء لمنشئها الأمير الكبير .

وختم هذا الوصف بما كانت عليه حوانيت التجارة حولها من رواج يشبه رواجها الحالى .

ظلت بركة الأزبكية عامرة بالدور والقصور حولها يسكنها أعيان مصر وسراتها . وألحقوا بدورهم الحدائق وأباحوها للشعب ينعم بالتنزه فيها . فكانت فرحة لسكان القاهرة يهرعون إليها فى الصيف والربيع ينعمون بالتنزه حول مياها والتمتع بمباهجها . وعند جفافها ينعمون بخضرتها وزهورها وتقام حولها أهم الحفلات .

وحينما زار مصر الرحالة عبد الغنى النابلسى سنة ١٦٩٣ م نزل فى دار[١] أسرة البكرى المطلة على البركة وكانت وقتئذ مزروعة فتناقش فى مساحتها وهل هى أعرض من مرجة دمشق أم المرجة أعرض منها ؟ مما دعاه إلى قياسها بالذراع الذى حدده بثلاثة أشبار . فكانت مساحتها ١٠٥٠ ذراعاً طولا فى ٤٤٢ ذراعاً عرضاً .

وفى سنة ١٧٧٦ م وقع حريق كبير فى أحد[٢] الأحياء حول البركة كان سبباً فى تلف كثير من الدور الكبيرة ، غير أن ولاة الأمور وقتئذ حتموا سرعة تعميرها بدرجة أنهم ألزموا غير القادرين على التعمير ببيع ما يملكون لمن يستطيع التعمير . وهكذا تم تعميرها فى أقرب وقت . فلم يحل ميعاد الفيضان الثانى حتى كانت الأزبكية أبهج وأحسن مما كانت عليه ، وهكذا نرى التاريخ يعيد نفسه .

وعند احتلال الفرنسيين لمصر اغتصبوا كثيراً من قصورها وأقاموا فيها وأنشاوا فى سنة ١٨٠٠ [٣] مسرحاً كوميديا كما أقاموا مطاعم وملاهى خاصة بهم حولها .

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(١) الحقيقة والمجاز رحلة النابلسى ص ٢٣٢ خط .
(٢) عجائب الآثار ج ٢ ص ٢ — ٣ .
(٣) عجائب الآثار للجبرتى ج ٣ ص ١٤٢ .

الروضة وما يتصل بها من جزائر إلى مصر القديمة وهى مساحة تزيد عن مساحة رأس البر .

وفى نهاية القرن الخامس عشر الميلادى وفى القرون الثلاثة التالية له ، كانت منطقة الأزبكية حول بركتها من أجمل متنزهات مصر . حيث عنى بها الأمير أزبك من ططخ كبير أمراء السلطان قايتباى ، فأزال كيمانها ، وأعاد حفر البركة ، وأجرى إليها الماء من الخليج الناصرى ، ثم أنشأ مناخاً لجماله ، كما أنشأ قصراً له فعرفت بالأزبكية نسبة إليه .

وما أن تم عمرانها حتى أنشأ بها مسجداً كبيراً ألحق به مكتبة نفيسه ، وأنشأ حوله حماماً ووكالة وقياسر للتجارة ، وقد رقع الفراغ من تلك المنشآت حوالى سنة ١٤٧٧ م. وكان من جرّاء حفر البركة وعمل رصيف حولها أن رغب سراة مصر فى سكنى الأزبكية ، فشادوا القصور وغرسوا الحدائق حتى صارت مدينة عامرة تبارى الشعراء والأدباء فى وصف جمالها .

ومن طريف ما وقفت عليه فى مدحها مقامة الشيخ شمس الدين محمد بن أبى بكر القادرى التى سماها «عرف الروضة الذكية فى وصف محاسن الأزبكية[1]» اقتطف منها تلك الفقرات .

فهى أحسن ما عمر فى عصرنا . وبها البركة التى ليس فى القاهرة أعظم منها ، ومن أيامها المعدودة ذلك اليوم الذى تنساب فيه إلى البركة مياه النيل ، حيث تضاء البركة والدور حولها ، وتدخل إليها المراكب مزدانة وتقام حولها حفلات الطرب .

أما فى زمن الربيع فان هذه البركة تزرع كلها قرطاً ، وتضرب الخيام حولها وتتحول إلى ربيع فى وسط المدينة يتمتع بها خلق كثير .

« ويعجبنى وصفه للمبانى بقدر ما يسمح له خياله فيصف المسجد بأن[2] أعمدته كشموع كبيرة ناصعة البياض ، ورخامه المدبج قد استعار من البستان خضرة رياضه ، ومن الليل والنهار لون سواده وبياضه ، وكأن شرفاته المرتفعات ،

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(١) نزهة الأمم لابن أياس ص ٢٤٦ خط .

(٢) هذا المسجد كان فى ميدان العتبة الخضراء حيث مدخل شارع الأزهر وقد هدم سنة ١٢٨٦هـ ١٨٦٩م واهتم بتصويره تجران باشا .

حسان نساء فى أزرهن متربعات ، وكأنه فى الليل والبدر غير محتجب ، سرادق من الفضة قد ضرب » .

ثم أخذ فى وصف منشآت الأمير أزبك حول البركة بأسلوب بليغ تحايل فيه ببلاغته على وصف تفاصيل العمارة الإسلامية أبلغ وصف .

فمن وصفه لقاعات القصر ورخامها : « وافتخرت على البقاع بقاعاتها التى هى كجنات تجرى من تحتها الأنهار ، تطرد بها آناء الليل وأطراف النهار ، من كل شاذروان تقر به العينان ، إذا انكسر ماؤه وانكسب ، تسلسل كالفضة على أرض من ذهب ، وقام بعد أن تكسر يجرى فى أخدود ، يسر الوارد عند الورود ، ينتهى من تلك الأخاديد إلى فساق ، تسع لسقيها عند الورود ألف ساق .

وتلك القاعات بها رخام ملون ، كأنه من بديع الزهر قد تكون ؛ فكأن بستانها أهدى لرخامها من رياضه حللا ؛ محكمة النسيج لا ترى خلالها خللا .

وكل مبيت يفضح الشموس والأقمار بقمرياته ، ويدهش العيون إذا نظرت إليه بحسن دهاناته ، إذا قابلت قمرياته الشمس إذا بزغت والقمر إذا طلع ، يظنان أن قوس السحاب وقع عليها لحبه إياها وقطع يقابلها الدهانات البعلكية ، التى تدهش العيون برؤيتها السنية ؛ وشى كالنقش الأخضر على ترائب الأتراب

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(١) نزهة الأمم لابن أياس ص ٢٥٥ (خط) .

(٢) الشاذروان هنا يفيد أنه السلسبيل الذى تنساب عليه المياه متعرجة على نقوشه المموجة وعادة يكون فى صدر السبيل أو الفسقية تنساب عليه المياه إلى الحوض أو فى صدر الأيوان تنساب عليه المياه إلى الفساق ، وكذلك فى قاعات القصور تنساب عليه المياه من أفواه الطيور فتسير فى قنوات حفرت عليها أنواع الأسماك حتى تصل إلى الفسقية أو البركة .

ولعلماء اللغة تفسيرات أخرى تغاير هذا .

وهذا الأديب فى وصفه البليغ أعطى للأثاريين مصطلحات معمارية دقيقة فيصف شرفات المسجد بحسان النساء فى أزرهن متربعات ، وفسر الشاذروان بأنه السلسبيل ، ووصف الرخام الدقيق باشكاله وألوانه ووصف القمريات (الشبابيك المستديرة ذات الزجاج الملون) أبدع وصف كما وصف جامات الحمام .

ولا شك فى أن هذه المقامة وصفت التفاصيل المعمارية أجمل وصف . وما أحوجنا إلى الكثير من وصف تلك التفاصيل .

ضُبط سالم أحد عربان العبابدة داخلا من باب القرافة وهو بزى امرأة ، وبالتحقيق معه وسؤاله عن تذكرته اعتذر عن تركها ، وقال إنه لم يتزىّ بزىّ النساء ، بل كان يحمل قميص والدته على كتفه ، وبعد معاقبته أطلق سراحه (الوقائع المصرية عدد ١٩٣ — ٩ ربيع آخر سنة ١٢٤٦) .

والبطاقات الشخصية ليست وليدة القرن التاسع عشر . فقد كانت نواتها موجودة بمصر منذ القرن الرابع عشر الميلادى . فان ابن بطوطة حينما زار مصر وذهب إلى دمياط قال « إذا دخلها أحد لم يكن له سبيل إلى الخروج إلا بطابع الوالى . فمن كان من الناس معتبراً طبع له فى قطعة كاغد يستظهر به لحراس بابها ، وغيرهم يطبع على ذراعه فيستظهر به[١] وهذا بلا شك (جواز مرور أو بطاقة شخصية) للوافدين على مصر من الأغراب . ثم حدثنا عن جوازات الدخول إلى مصر والخارجين منها حينما وصل إلى بلدة قطيا باعتبارها الحد الفاصل بين الشام ومصر وفيها الجمرك والدواوين فقال :

« ولا يجوز عليها أحد من الشام إلا ببراءة من مصر ، ولا إلى مصر إلا ببراءة من الشام احتياطاً على أموال الناس وتوقياً من الجواسيس العراقيين ، وكان يعهد إلى العرب بحراسة الحدود عند هذه البلدة ، وطريقها فى ضمان العرب ، فاذا كان الليل مسحوا على الرمل فلا يبقى به أثر ، ثم يأتى الأمير صباحاً فينظر إلى الرمل ، فان وجد به أثراً طالب العرب باحضار مؤثره[٢] ، فيذهبون فى طلبه فلا يفتهم فيأتون به الأمير فيعاقبه بما شاء » .

وللصديق المحقق ميخائيل عواد بحث ممتع فى جوازات السفر حوى معلومات جديدة طريفة نشرت فى مجلة الكتاب ص ٤٠ — ٥٠ عدد مايو سنة ١٩٤٦ يرجع إليه من رغب التوسع فى هذا الموضوع . ويعتبر ماذكرناه مكملا لبحثه .

تقسيم القاهرة

مما سبق يتضح أن القاهرة قسمت إلى مناطق سكنية ، ومناطق صناعية . كما قسمت أيضاً إلى مناطق لهو برىء ، وغير برىء ، ومتنزهات خلوية ، فمن مواطن

(١) رحلة ابن بطوطة تحفة النظار فى غرائب الأعصار وعجائب الأسفار ج ١ ص١٦ .
(٢) رحلة بن بطوطة ج ١ ص ٣٠ .

اللهو غير البرىء قنطرة الحاجب على الخليج المصرى حيث كانت مقر أهل الطرب والخلاعة . وكانت العامة تقول فى هزلها :

ستى ، أين كنتى ، وأين رحتى ، وأين جيتى ؛ قالت : من ربع الزيتى[١] .

هذا عدا المناطق المخصصة لعصير الخمر وبيعه وغالبها أماكن نزهة أو يسكنها غير المسلمين مثل حارة السودان ، وحارة الساشا ، وكوم دينار ، وبركة اليقطين ، وحارة عكا ، والجزيرة ، والمريس ، والباطلية ، وشبرا ، ومنية السيرج ، وحارة زويلة ، وحارة الروم الجوانية ، وسويقة صفية ، وقنطرة الفخر[٢] .

وكانت مواطن اللهو البرىء فى رحبة باب اللوق ، وكانت تجمع رحاباً خمس وبها كان يجتمع فى القرن الخامس عشر الميلادى أرباب الملاعب المسلية كالمشعبذين ولاعبى خيال الظل والحواة والبهلوانية وغيرهم[٣] .

وكانوا فى القرن الرابع عشر يجتمعون فى منطقة أخرى متاخمة لها عند جامع الطباخ القريب من ميدان (عابدين) .

أما متنزهاتها فكثيرة على ضفاف النيل ، وعلى حافتى الخليج ، وحول برك الفيل والحبش والرطلى ، والأزبكية ، وشبرا وخارج الحسينية وجزيرة الروضة وغير هذا كثير .

وعلى الجزائر وضفاف البرك أقيمت السرادقات والأخصاص فى فصل الصيف ففى سنة ٧٤٧ هـ — ١٣٤٦ م ظهر فى النيل جزيرة حليمة فاتصلت بجزيرة الزمالك وأقبل سكان مصر على التصييف فيها فانشأوا بها عدة أخصاص (عشش) تفننوا فى تشييدها حتى بلغت نفقات الخص نحو[٤] مائة وخمسين جنيهاً ما بين رخام ونقوش وحدائق حوله . وكانت الإقامة فى تلك الأخصاص وفى أخصاص جزيرة الطينة أمام أثر النبى بمصر القديمة يستغرق ستة شهور .

وبذلك انتفع سكان مصر والقاهرة بجزائر النيل ابتداء من بولاق وجزيرة

(١) المقريزى (المواعظ والاعتبار) ج ٢ ص ٧٨ .
(٢) حلبة الكميت ص ٤٠ .
(٣) المقريزى (المواعظ والاعتبار) ج ٢ ص ٥١ .
(٤) المقريزى (المواعظ والاعتبار) ج ٢ ص ١٨٦ .

كثرت فى تلك الأيام ، وصاروا يهجمون على الأسواق والحارات[1] .

وفى سنة ٩٢٢ هـ — ١٥١٦ م أمر الأمير الماس والى الشرطة بالقاهرة بأن يعمر السكان على الحارات والأزقة دروباً فى أماكن شتى ، فعمروا دروباً فى رأس سوق الدريس ، وفى الحسينية ، وعلى قنطرة الحاجب ، وعندالمقس[2] وعدة دروب فى أماكن شتى ، وأن يعلقوا على كل دكان قنديلا ، وأن لا يخرج أحد من الناس من بيته بعد العشاء ، وذلك اتقاء لشر اللصوص وحدوث الحرائق المفتعلة .

وحينما كانت تقع اضطرابات سياسية أو غيرها كانت تغلق أبواب المدينة وأبواب الدروب والخوخات التى بالحارات . وهذا ما حدث فى[3] ٢٩ ذى القعدة سنة ٩٢٣ هـ — ١٥١٧ م .

وقد حدثنا عن تلك البوابات الجبرتى فى عهد الاحتلال الفرنسى لمصر فقال :

فى سنة ١٢١٣ هـ — ١٧٩٨ م شرع الفرنسيون فى تكسير أبواب الدروب والبوابات النافذة ، وخرج عدة من عساكرهم يخلعون أبواب الدروب والعطف والحارات . كما خلعوا أبواب الدروب الغير نافذة أيضاً ، ونقلوا الجميع إلى بركة الأزبكية عند رصيف الخشاب .

وفى جمادى الأولى من تلك السنة خلعوا أبواب الدروب والحارات الصغيرة الغير نافذة ، وهى التى تركت وسومح أصحابها وبرطلوا عليها . وكذلك دروب الحسينية ونقلوها إلى ما جمعوه من البوابات بالأزبكية ، ثم كسروها وباعوها للوقود[4] .

ومن وصف الجبرتى نعلم أن البوابات استعملت بكثرة للحارات والدروب .

وفى أوائل القرن التاسع عشر وحينما استتب الأمن[5] صدرت الأوامر بنزع البوابات التى على الدروب مبالغة فى استقراره .

(١) بدائع الزهور فى وقائع الدهور لابن أياس جـ ٢ ص ٣٣٦ .
(٢) بدائع الزهور فى وقائع الدهور لابن أياس جـ ٣ ص ٣٣ .
(٣) بدائع الزهور فى وقائع الدهور لابن أياس جـ ٣ ص ١٤٣ .
(٤) عجائب الآثار للجبرتى جـ ٣ ص ٢٩ .
(٥) عبر البشر فى القرن الثالث عشر ص ٤١ (خط) .

ورغم ما أصاب البوابات من التخريب فقد بقيت منها بقية صغيرة فى أنحاء القاهرة كان الفضل فى بقائها تسجيلها ضمن الآثار العربية مثل باب حارة زقاق المسك بالخيمية ، وحارة الألايلى بالغورية وبوابة طرباى بباب الوزير وباب درب الميضة بالجمالية ، وباب حارة برجوان بالنحاسين ، وباب متصل بقبة تتر الحجازية بالقفاصين قسم الجمالية ، وبوابة بيت القاضى بجوار قسم الجمالية.

هذا عدا ما هو موجود منها فى سوق الفحامين ومصر القديمة على الدرب المؤدى إلى قاعة العرسان ، وعلى الدرب المؤدى الى كنيسة أبى سرجة . وباب حارة سعد الدين بالقرب من مسجد أصلم السلحدار بدرب شغلان ، وباب حارة زعيتر بشارع بولاق الجديد ، وباب درب البارودية لصق قبة الغورى بالغورية .

وكانت تلك البوابات تغلق فى الليل ويعين لها الحراس ، فيظلون طول الليل فى موضع المراقبة وهم مسلحون ، فيغلقونها عقب صلاة العشاء ، ولا يفتحونها لطارق مجهول أو قادم إلا إذا أسر إليه بكلمة السر المتفق عليها مع السكان فى تلك الليلة . أو قدم له بطاقته الشخصية .

البطاقات الشخصية

فى ٢٣ ربيع الأول من سنة ١٢٤٥ هـ — ١٨٢٩ م قرر مجلس المشورة بالقاهرة أن يكون بيد كل إنسان تذكرة مختومة بختم مصر يقدمها عند خروجه[1] من أبواب مصر أو دخوله فيها وعند انتقاله من بلد إلى أخرى .

ونصت المادة ١٩٤ ضمن البنود المنتخبة من[2] الجمعية الحقانية فى ٩ شعبان سنة ١٢٦٠ هـ — ١٨٤٤ م على « أن كل من يوفق تذكرة مرور بالزور ، أو يصنع حيلة فى تذكرة مرور يكون أصلها صحيحاً ، أو يستعمل تزويرات مثل ذلك ، أو تذكرة مرور ذات حيلة فانه يجازى بارساله إلى اللومان بمدة من ستة أشهر إلى سنتين »

وكان يعهد إلى (البصاصين) رجال البوليس الملكى بمراقبة مداخل القاهرة والاطلاع على البطاقات ، حتى إذا تبين أن أحداً لا يحمل بطاقة عذر وأنذر ، فقد

(١) الوقائع المصرية الصادرة فى ١٩ ربيع الأول سنة ١٢٥٤ هـ .
(٢) قانون منتخبات ص ١٠٣ .

يميل إلى الصفرة وعلى اللوحة البيضاوية تحتها كتب بخط فارسى (السكرية) ، وتبدو الحروف بيضاء لزوال التلوين . وقد اتفقت نصاً وتلويناً .

وينص البند العاشر على أن تسمية الطريق من سبيل الجمالية إلى باب الفتوح ، باب الفتوح تكتب باللون الأحمر — ويفحص اللوحة المثبتة على باب الفتوح تبين أنه كان مكتوباً عليها بالمداد الملون (باب الفتوح) .

وينص البند الثالث على تسمية الشارع الممتد من باب السيدة البرانى إلى قره قول باب الخلق ، شارع السيدة بحروف حمراء على أرضية صفراء وبرواز أحمر . وبفحص اللوحات التى عثرت عليها وجدت إحداها على مسجد قراقجا الحسنى مكتوب على الرئيسية منها شارع السيدة والفرعية درب الجماميز ، ويغلب على الحروف البياض مما يفيد فقدان اللون ، وفى الأرضية اصفرار .

والثانية على سبيل السلطان محمود ومكتوب عليها شارع درب الجماميز ؛ والفرعية ضلع [1] السمكة ، ويغلب على الحروف البياض مما يفيد فقدان اللون وفى الأرضية اصفرار .

وهذا يعزز ويؤكد اتفاق ماعثرت عليه فى أهم الشوارع مع ما جاء فى البنود نصاً وتلويناً .

وقد وجدت أثر التلوين فى أرضية لوحة سكة باب الوزير على مسجد إيتمش البجاسى بشارع القلعة القديم ، وجليا فى الإطار الأحمر حولها .

وقد اتفقت تلك اللوحات فى الوصف والمقاس ، فاللوحات الرئيسية مستطيلة مقاسها ٨٧ر٠ × ٤٧ر٠ سم والفرعية تحتها بيضاوية ، مقاس ٤٩ر٠ × ٤١ر٠ سم .

أما نمر الدور فيوجد الكثير منها على الدور السابقة للقرن التاسع عشر ومنشآت أوائله ، وهى مربع صغير من الجص أحيط باطار من البوية السوداء أو الحمراء يتوسطه الرقم باللون الأسود ، أو الأحمر ، ومنها ما هو مثبت على جانب الباب أو فوق عقده ، وقد وجدت منها الكثير فى مصر ورشيد والمنصورة .

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(١) لم يرد فى البنود ذكر للتسمية الفرعية (ضلع السمكة) وقد ذكرها على باشا مبارك عند ذكره لمسجد كاتم السر الذى هدم فى توسعة الخليج وعند ذكره لتكية السلطان محمود فى الجزء الثالث ص ٩ من الخطط التوفيقية .

ومن البلدان التى عثرت فيها على لافتات بأسماء الشوارع (أسيوط) حيث وجدت لوحة على مسجد الكاشف ، ومدينة رشيد ، حيث وجدت عدة لوحات ، منها ما هو على مسجد الشيخ تقى ، وعلى منزل الأمصيلى ، وعلى منزل المناديلى والحاج يوسف بحارة الحاج يوسف ، وكلها أماكن منشاة فى القرنين الثامن عشر وأوائل التاسع عشر الميلادى وهى تطابق مثيلاتها فى مصر ، غير أنها خالية من اللوحات الفرعية .

ولا شك فى أن ما وجدته من لوحات أسماء الشوارع ونمر الدور فى مصر والأقاليم باقية من وقت صدور الأمر بعملها .

بوابات الحارات

بعد أن امتد العمران خارج القاهرة وأحدثت فى أسوارها أبواب جديدة لتعدد مسالكها ، أقيمت على الدروب والحارات أبواب لمنع السرقات ، ذلك أنه فى سنة ٨٦٤ هـ — ١٤٥٩ م كثرت السرقات ، فاهتم [1] الأغنياء باقامة البوابات على الحارات والدروب ، وعينوا لها البوابين فكانت تغلق عقب صلاة العشاء وبعضها كان يغلق عقب الغروب بقليل .

وقد نبهت الكتب المؤلفة فى سياسة الدول الإسلامية على ضرورة يقظة حارس الدرب ، وعدم السماح للغرباء بالدخول إلا بعد التحقق [2] منهم ، والتحرى عنهم ، وأن يقوم بالتبليغ عن الحرائق والسرقات ، ولا يدلى بأسرار السكان لوال أو لغيره .

وقد ورد ذكر أبواب الدروب والخوخات فى عدة حوادث من تاريخ القاهرة نذكر فقرات منها .

فى سنة ٩٠٣هـ — ١٤٩٧ م أمر والى القاهرة ، بأن ينادى باسم السلطان . بأن سكان الأسواق والحارات يعملون عليها دروباً ، فامتثلوا لأمره ، وبنيت بالقاهرة عدة دروب : منها ما هو على سوق تحت الربع وعلى سوق أحمد بن طولون ، وعلى سوق أمير الجيوش وغير ذلك من الأسواق والحارات . لأن المناسر كانت

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(١) حوادث الدهور لابن تغرى بردى قسم ٢ ص ٣٣٢ .

(٢) معيد النعم ومبيد النقم ١٤٥ .

فى هذا البيان وخاصة الشوارع الرئيسية ، فانى وجدت الكثير منها فى شوارع بولاق ، ومصر القديمة ، غير أنها لم ترد فى هذا البيان ، وهى مناطق أثرية آهلة بالسكان . كما أنه لم يتضمن مسميات الحارات فى المناطق التى سمى شوارعها (١) . بالرغم من وجود لافتات بها .

وقبل التحدث عنها ، أناقش التعليق الملحق بالبند الخامس عشر ، والمتضمن صعوبة كتابة أسماء الشوارع على الجدران ، لما فيه من مشقة على كاتبها بسبب مرور الناس والعربات ذات الأحمال ، واستحسان كتابتها على ألواح خشبية تعلق وتثبت .

والأمر الثانى تلوين بعض اللوحات فى مختلف الأحياء . فأذكر أن جميع اللوحات التى عثرت عليها من الجص المثبت على الجدران . وأن مسمياتها وألوانها تتفق مع ما جاء فى بنود البيان . كما أن الكثير من الكتابات بالمداد الأسود ، ووجدت فى أرضيات بعضها أثر التلوين ، وهذا يجعلنى أؤكد أنه حصل عدول عن كتابتها على ألواح خشبية وعن التلوين فى بعضها واستعيض عنها بألواح جصية . صبت وكتبت ثم لونت وركبت أو عملت على (بيتها) حسب اصطلاح الصناع وهو سر بقائها للآن . وكانت ملونة وفقدت تلوينها حيث وصلت إلينا مع مضى الزمن بيضاء أو حروفها بيضاء .

ومما يعزز أن تلك اللوحات عملت تنفيذاً للأمر الصادر سنة ١٨٤٧ ، مطابقة نصوصها للبيان كما أسلفت ، وأن جميع ماعثرت عليه منها مثبت على منشآت أثرية تسبق عصر محمد على أو على منشآته أو منشآت عصره ، وأذكر على سبيل المثال بعض الأماكن المثبتة عليها : باب الفتوح — باب زويلة — مسجد قجماس الإسحاقى بالدرب الأحمر — سبيل عمر أغا بشارع التبانة — مسجد إيتمش البجاسى برأس باب الوزير — سبيل العقادين (محمد على) بحارة الروم — مسجد الغورى منزل أوده باشى بالجمالية — بوابة السلحدار برأس حارة بيرجوان — دار المحفوظات بالقلعة ، وسور العلقة — باب درب اللبانة بالمنشية — مسجد مرزا ببولاق — مسجد

(١) لعل البيان الذى ننشده هو المشار إليه فى العدد ٦٤ من الوقائع ، أو لعله السابق الوعد به فى التعليق على البند الخامس عشر . والقائل فيه « عند انتهاء التسميات يدرج ذكرها فى الوقائع ليكون معلوماً للعامة .

القاضى يحيى بشارع المحكمة ببولاق ، سبيل حبيش تحت الربع — سبيل السلطان مصطفى بميدان السيدة زينب — سبيل السلطان محمود بدرب الجماميز — مسجد قراقجا الحسنى باللبودية — باب قايتباى بالسيدة عائشة — مدفن تمرباى الحسينى بشارع القادرية بالخليفة — سبيل القبرصلى بالفحامين — بوابة كنيسة أبى سرجة وحارة مار جرجس بمصر القديمة — وكالة المشنات ببولاق — سبيل محمد كتخدا بالداودية .

وجميع الأماكن التى ذكرت تسبق سنة ١٨٤٧ م ومنها ماهو من منشآت القرن التاسع عشر المنشأة قبل صدور الأمر بعمل اللوحات .

كما أنها لم توجد على منشآت معمارية بعد سنة ١٨٤٧ مما يجعلنى أؤكد أن جميع ماعثرت عليه منها يرجع الى أول القرن التاسع عشر ، وفقط استعيض عن اللوحات الخشبية بلوحات جصية كانت أيسر تثبيتاً وبقاء .

وبدراسة الشوارع الرئيسية طبقاً لما ورد فى بنود هذا البيان ، وجدت لوحاتها الموجودة مطابقة لها . فقد نص البند الأول على تسمية الشارع الممتد من باب الخلق إلى القلعة ، باسم شارع القلعة ، فوجدت أن اللوحة المثبتة على البدنة الغربية لباب زويلة مكتوب عليها (شارع القلعة) بحروف سوداء تحتها لوحة بيضاوية صغيرة كان بها اسم الشارع الفرعى — لعله الدرب الأحمر(١) — وهذا يطابق ماورد فى التعليق الملحق بالبند الخامس عشر من كتابة اسم الشارع بخط جلى وكتابة اسم المحل تحته بخط رفيع بالنسبة إليه — كما وجدت لوحة مثبتة على سبيل عمر أغا أما مسجد آق سنقر (ابراهيم أغا مستحفظان) بشارع باب الوزير مكتوب عليها شارع القلعة وعلى اللوحة البيضاوية تحتها الخربكية بخط فارسى صغير ، وقد اتفقت نصاً وتلويناً .

وجاء فى البند التاسع أن الجادة الممتدة من باب زويلة الى الجمالية ، تسمى بشارع الغورى ، ويكون لون خطها وبروازها أحمر وأرضيتها صفراء .

وبفحص اللوحة الموجودة على البدنة الشرقية لباب زويلة ، وجدتها مكتوباً عليها (شارع الغورى) وقد بدت بقايا الحروف بيضاء وبالأرضية أثر تلوين

(١) هو فعلا الدرب الأحمر لأن البند رقم ٤٩ اعتبر جامع قجماس الأسحاقى بشارع الدرب الأحمر.

(البند الأربعون)

إن الطريق الممتدة من شارع طولون المنتهية إلى شارع الرميلة ، تسمى بسكة بير الوطاويط ، ونمرتها تكون حمراء .

(البند الحادى والأربعون)

إن الطريق الممتدة من أمام بئر الوطاويط الواصلة إلى باب البركة ، تسمى بسكة أزبك ، ونمرتها تكون حمراء .

(البند الثانى والأربعون)

إن الطريق الممتدة من عمارة حسنى باشا المارة على الشيخ نور الظلام ، الواصلة إلى جادة الصليبة قريباً من بيت محمود بك ، تسمى بسكة الشيخ نورالظلام ، ونمرتها تكون حمراء .

(البند الثالث والأربعون)

إن الطريق المتمدة من المحجر أمام بيت المرحوم ابراهيم باشا يكن ، الواصلة إلى شارع سوق السلاح ، تسمى بسكة الكومى ، ونمرتها تبدأ من جادة سوق السلاح ، وتكتب بالمداد الأسود .

(البند الرابع والأربعون)

إن الطريق الممتدة من أمام قره قول باب الوزير إلى سكة الكومى ، تسمى بعطفة الكوم الوسخة ، وتكون نمرتها سوداء .

(البند الخامس والأربعون)

إن الطريق المبتدئة من شارع القلعة الممتدة إلى سكة الكومى، تسمى بدرب القزازين ، وتكون نمرتها حمراء .

(البند السادس والأربعون)

إن الطريق الممتدة من جامع ابراهيم أغا الكائن بشارع القلعة إلى جامع أصلان (أصلم) ، تسمى بدرب شغلان ، وتنمر بالمداد الأحمر .

(البند السابع والأربعون)

إن الطريق الممتدة من قره‌قول التبانة الى الدرب المحروق ، تسمى بشارع النبوية وتنمر بالمداد الأحمر .

(البند الثامن والأربعون)

إن الطريق الممتدة من الدرب المحروق إلى باب المحجر ، تسمى بالدرب المحروق وتنمر بالمداد الأحمر .

(البند التاسع والأربعون)

إن الجادة الممتدة من جامع قجماس الكائن بالدرب الأحمر بشارع القلعة إلى الدرب المحروق ، تسمى بير المش[1] وتنمر بالمداد الأسود .

(البند الخمسون)

إن الطريق المبتدئة من باب الخلق الممتدة إلى جادة الحمزاوى ، تسمى درب سعادة ، وتنمر بالمداد الأحمر[2] .

ونشرت الوقائع المصرية فى عددها رقم ٨٤ فى ٧ شوال سنة ١٢٦٣ هـ ، أن الإرادة السنية تعلقت بتنمير المساكن والدكاكين والأزقة وجميع المحال بمصر والاسكندرية . كما صدر أمره العالى أن يتبع هذا النظام أيضاً فى رشيد ودمياط ، ثم باقى بنادر الوجه البحرى ، كالمنصورة ، وسمنود ، وفوه وطنتدا ، وأسيوط وغيرها من البنادر المماثلة لها ويكون ذلك بمعرفة الضباط الأربعة المكلفين بالتنمير بمصر المحروسة .

* * *

نخرج من هذا البيان بعدة فوائد : أولها تخطيط القاهرة فى القرن التاسع عشر مع بيان هام لأكبر شوارعها وبعض سككها المتفرعة منها ، وبواباتها وتحديد بعض قره قولات البوليس بها ، غير أننى أقرر أن لهذا البيان ملحقاً لم أقف عليه ، لأنه لم يتناول أسماء الشوارع فى مصر القديمة ولا بولاق ؛ بالرغم من وجود لافتات بها ، ومع أنى عثرت على الكثيرمن لافتات الشوارع ونمر الدور فى المناطق الواردة

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(١) رأيت هذه اللافتة على منزل خلف مسجد قجماس (أبو حريبة) . من الجهة البحرية الشرقية وقد هدم وأعيد بناؤه .

(٢) الوقائع المصرية العدد ٨٣ فى ٢٩ رجب سنة ١٢٦٣ هـ وتقويم النيل ج ٢ ص ٥٤٧— ٥٥٢ .

(٣) تقويم النيل ج ٢ ص ٥٥٤ والعدد ٨٧ من الوقائع المصرية فى ٤ رمضان سنة ١٢٦٣ هـ .

(البند الخامس والعشرون)

إن الجادة الممتدة من شارع الأستاذ الحنفى إلى جادة الناصرية ، تسمى بدرب القرودى ، ونمرتها تكون حمراء .

(البند السادس والعشرون)

إن الطريق الممتدة من قنطرة السيدة زينب إلى عطفة عمر شاه ؛ تسمى بشارع الدرب الجديد . والطريق الممتدة من باب عطفة عمر شاه الموصلة إلى شارع الهياتم ودرب القرودى ، تسمى بشارع سويقة اللالة ، والطريق الممتدة من الشارع المذكور إلى جادة الناصرية ، تسمى بشارع الحنفى ، وتكون نمر هذا الطريق بالمداد الأحمر ، والطريق التى من جادة الحنفى إلى سبيل الخليج ، تسمى بشارع الهياتم ، وتكون نمرتها سوداء .

(البند السابع والعشرون)

إن الطريق الممتدة من قنطرة عمر شاه إلى شارع الدرب الجديد ، تسمى بشارع عمر شاه ، وتكون نمرتها سوداء .

(البند الثامن والعشرون)

إن الطريق الممتدة من جادة درب الجماميز إلى عطفة كوزأغلى ، تسمى بشق العرسة ، ونمرتها تكون سوداء .

(البند التاسع والعشرون)

إن الطريق التى تمتد من جادة حضرة السيدة زينب إلى عطفة الشيخ السادات ، تسمى بعطفة كورأغلى ، ونمرتها تكون سوداء .

(البند الثلاثون)

إن الجادة التى تمتد من قنطرة درب الجماميز إلى شارع الحنفى ، تسمى بشارع خليل طينة ، وتكون نمرتها سوداء .

(البند الحادى والثلاثون)

إن الطريق الممتدة من شارع السيدة زينب المارة نحو بيت الشيخ السادات المنتهية إلى بركة الفيل ، تسمى بشارع السادات ، وتكون نمرتها سوداء .

(البند الثانى والثلاثون)

إن الجادة المبتدئة من أمام مسجد السيدة زينب الممتدة إلى الجهة الغربية من الخليج ، تسمى بحارة السيدة زينب ، ونمرتها تكون سوداء .

(البند الثالث والثلاثون)

إن الطريق الممتدة من جانب قنطرة سنقر إلى عطفة قرا على بجوار الخليج تسمى بشارع الخليج ، ونمرتها تكون حمراء .

(البند الرابع والثلاثون)

إن الطريق المبتدئة من الباب المحازى لقنطرة الذى كفر المنتهية إلى شارع عابدين ، تسمى بشارع رحبة عابدين ، وتكون نمرتها سوداء .

(البند الخامس والثلاثون)

إن الطريق المبتدئة من باب حارة النصارى المارة من سوق الجمعة الممتدة إلى سويقة السباعين بجادة الناصرية ، تسمى بشارع سوق الجمعة ، وتكتب نمرتها بالمداد الأسود .

(البند السادس والثلاثون)

إن الطريق الممتدة من باب حارة النصارى الكائن بشارع سوق الجمعة المتصل بقنطرة سنقر ، تسمى حارة النصارى ، ونمرتها تكون حمراء .

(البندالسابع والثلاثون)

إن الطريق الممتدة من الباب القريب من درب الجماميز إلى شارع سوق الجمعة ، تسمى بسوق مسكة ، وتكون نمرتها حمراء .

(البند الثامن والثلاثون)

إن الزقاق الممتد منشارع الحنفى إلى سوق الجمعة ، يسمى بعطفة الفقوسة ، وتكون نمرتها سوداء .

(البند التاسع والثلاثون)

إن الطريق الممتدة من شارع السيدة نفيسة إلى سوق العصر المعادلة لجادة طولون ، تسمى بشارع درب الحصر ، ونمرتها تكون سوداء .

(البند الرابع عشر)

إن الطريق الممتدة من زاوية الموسكى إلى الاسبتالية (١) الملكية الكائنة بالأزبكية تسمى بشارع الموسكى ، ويكون لون خطها وبراوزها أسود .

(البند الخامس عشر)

إن الطريق الممتد من شارع باب الخلق ، إلى شارع الغورى ، تسمى بشارع الحمزاوى ، ويكون خطها وبراوزها أسود .

وأعقب البند الخامس عشر هذا التعليق :

« لما كانت الشوارع المحررة أعلاه إذا كتبت أسماؤها على الحيطان يحصل فيها مشقة على من يكتبها ولا تتحصلْ بسرعة كما ينبغى ، بل تطول مدتها ولا يمكن كتابتها مع الراحة بسبب ذهاب الناس وإيابهم فى الأزقة ، ومرور الحيوانات ذوات الأحمال والعربات أيضاً ، استنسب أن تحرر أسماؤها على ألواح ثم تعلق عليها وتسمر بالمسامير .

ومن حيث أن نمر البيوت ليست بالمثابة المذكورة لزم أن تكون كتابتها فوق الأبواب أو بجانبها حسب الاقتضاء . وإذا كانت النمر المذكورة ترتب على قدر طول الشوارع كما ذكر . ومن المعلوم أن كل شارع منها يشمل محلات كثيرة مسماة باسماء مشهورة ، استنسب أن تكون كتابة اسم الشارع المشتمل على النمر فى ألواح الزوايا بخط جلى وأن يكتب اسم المحل تحته بخط رفيع بالنسبة إليه ، حتى أن كل من نظر إلى اللوحة يعلم اسم المحل الذى هو فيه .

ولما كان من مقتضيات الإرادة السنية إتمام مامورية تنمير البيوت التى فى الأزقة الآتى ذكرها بسبب ما حصل من اجتهاد المأمورين والعمال الذين عينوا لذلك وشرع فى وضع نمر ما بقى من البيوت . وعند انتهائها يدرج ذكرها فى الوقائع ليكون معلوماً للعامة .

(البند السادس عشر)

إن الجادة الممتدة من قنطرة السيدة زينب إلى باب حارة الزير المعلق بآخر شارع درب الحجر ، تسمى بشارع الناصرية ، تكتب نمرتها بالمداد الأحمر .

(١) هى دار الشفاء التى كانت بالعتبة الخضراء .

(البند السابع عشر)

إن الطريق الممتد من قنطرة سنقر إلى باب الزير المعلق ، تسمى بشارع درب الحجر ، وتكون نمرتها سوداء .

(البند الثامن عشر)

إن الطريق التى من باب قره قول سويقة السباعين ، بشارع الناصرية إلى حارة السقايين ، تسمى بشارع درب الحمام وتكتب نمرتها بالمداد الأسود .

(البند التاسع عشر)

إن الطريق التى من باب الزير المعلق الكائن بدرب الحجر إلى بيت شربتجى باشا ، تسمى بسكة الزير المعلق ، وتكون نمرتها بالمداد الأحمر .

(البند العشرون)

إن الطريق التى ابتدأوها من شارع درب الحجر المارة من عابدين المنتهية إلى جادة باب اللوق ، تسمى عابدين ، وتكون نمرتها حمراء .

(البند الحادى والعشرون)

إن الجادة الممتدة من شارع باب اللوق المارة تجاه بيت حضرة الباشا مدير المالية المنتهية إلى الجبانة ، تسمى بشارع البيدق ، ونمرتها تكون حمراء .

(البند الثانى والعشرون)

إن الطريق التى تمتد من باب الخوخة إلى شارع باب اللوق ، تسمى بشارع البلاقسة ، ونمرتها تكون حمراء .

(البند الثالث والعشرون)

إن الطريق الممتدة من باب درب أبى الليف إلى شارع الشيخ ريحان ، تسمى بشارع حارة السقايين ، ونمرتها تكون حمراء .

(البند الرابع والعشرون)

إن الطريق الممتدة من درب باب أبى الليف بشارع الناصرية إلى باب حارة السقايين ، تسمى بشارع أبى الليف ، وتكون نمرتها حمراء .

تنظيم المحروسة ، على التدابير اللازمة لذلك ، طبق الإرادة السنية ، واندرج بيانها تفصيلا فى نسخ الوقائع المنمرة برقم ٦٤ وحصل فى هذه الأيام الشروع فى إجراء ذلك ابتداء من باب الخلق بمقتضى الترتيب الآتى ذكره أدناه وهو خمسة عشر بنداً :

(البند الأول)

حيث إن خليج مصر المحروسة ماراً من وسطها تقريباً ، وكان باب الخلق متصلا بالخليج المذكور ، ومركزاً لمصر المحروسة ، استنسب أن تكون الجادة الممتدة من باب الخلق إلى القلعة ، تسمى بشارع القلعة[1] ، ويكتب على رأس زوايا تلك الطرق اسم شارع القلعة وتكتب نمر البيوت الكائنة هناك على أرضيات بيضاء بمداد أسود ، يحيط بها براوز لونه كلون مداد الأحرف ، وتنمر البيوت التى عن يمين المار بباب الخلق بنمرة الوتر ، والتى عن يساره بنمرة الشفع ، أى تكون التى فى الجهة اليمنى غير مزدوجة ، والتى فى الجهة اليسرى مزدوجة إلى انتهائها بناحية القلعة .

(البند الثانى)

أن تسمى الطريق الممتدة من باب الخلق إلى مبرك النوق المعبر عنه الآن بباب اللوق بشارع باب اللوق . وابتدأ بالنمر من باب الخلق على الوجه المشروح بالنسق المذكور فى الأحرف والبرواز والأرضية .

(البند الثالث)

إن الجادة الممتدة من باب السيدة زينب البرانى ، إلى غاية قره قول باب الخلق تسمى بشارع السيدة زينب ، ويكون لون أرض لوحتها أصفر ، ولون أحرفها وبروازها أحمر .

(البند الرابع)

إن الطريق الممتدة من باب الخلق إلى زاوية الموسكى ، تسمى بشارع باب الخلق ويكون لون أحرفها أحمر كذلك ، وأرضية لوحتها صفراء .

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(١) كان الشارع الرئيسى الموصل الى القلعة من باب الخلق هو تحت الربع ، فالدرب الأحمر فالتبانة ، فباب الوزير حيث لم يكن شارع محمد على موجوداً وقتئذ .

(البند الخامس)

إن الجادة التى من زاوية الموسكى إلى غاية باب العدوى ، تسمى بشارع الشعرانى ، وتكون أحرفها حمراء أيضاً ، وأرض لوحتها صفراء .

(البند السادس)

إن الطريق الممتدة من قره قول السيدة زينب إلى القلعة ، تسمى بشارع الرميلة ، وتكون أحرفها وبروازها بالمداد الأسود ، وأرضيتها بيضاء .

(البند السابع)

إن الجادة الذاهبة من قره قول الصليبة إلى باب زويلة ، تسمى بشارع الصليبة ، ويكون لون خطها أحمر على أرضية صفراء .

(البند الثامن)

إن الطريق الممتدة من السيدة نفيسة إلى قره قول الصليبة ، تسمى بشارع السيدة نفيسة ، ويكون لون خطها وبروازها أحمر ، وأرضيتها صفراء .

(البند التاسع)

إن الجادة المتمدة من باب زويلة إلى سبيل الجمالية ، تسمى بشارع الغورى ، ويكون لون خطها وبروازها أحمر ، على أرضية صفراء .

(البند العاشر)

إن الطريق الممتدة من سبيل الجمالية إلى باب الفتوح ، يعبر عنها بشارع باب الفتوح ، ويكون لون خطها وبروازها أحمر ، وأرضيتها صفراء .

(البند الحادى عشر)

إن الجادة التى من السبيل المذكور إلى باب النصر ، تسمى باب النصر ، ويكون لون خطها وبروازها أحمر ، وأرضيتها صفراء .

(البند الثانى عشر)

إن الجادة الكائنة من قره قول باب الشعرية إلى الباب الجديد ، يعبر عنها بشارع الباب الجديد ، ويكون لون خطها وبروازها أسود .

(البند الثالث عشر)

إن الطريق التى من القره قول المذكور إلى باب الفتوح ، تسمى بشارع مرجوش ، ويكون لون خطها وبروازها أسود .

وإلى القرن الخامس عشر كان والى الطوف (صاحب العسس) يجلس كل ليلة بعد العشاء فى منطقة الغورية وأمامه مشعل وحوله عدة من الأعوان وكثير من السقائين ، والنجارين ، والقصارين ، والهدادين بنوب مقررة لهم ، خوفاً من أن يحدث فى القاهرة حريق بالليل ، فيتداركون إطفاءه ، ومن حدث منه فى الليل خصومة ، أو وجد سكراناً ، أو قبض عليه من السراق ، تولى أمره والى الطوف ، وحكم عليه بما تقتضيه الحال[1] .

مصلحة الاطفاء

ظل الشعب بالاشتراك مع الحكومة يكافح الحرائق إلى حوالى سنة ١٨٤٥م حيث أنشىء قسم لطلمبات الحريق (مصلحة الإطفاء) وإلحاق تسعين جندياً به ، وإيداع طلمبة فى كل خط من أخطاطها ، واستحضرت الأدوات اللازمة لصنع آلات الإطفاء بمصر .

ثم صدرت التعليمات إلى المشرفين على المطافىء بأن يرفعوا عقب كل حريق تقريراً عن أسباب الحريق ، وبيان الخسائر ، والمدة التى أخمد فيها الحريق .

وتحدثنا الوقائع المصرية عن نماذج لبعض الحوادث ووصفها ، ننشرها بنصها :

« فى ١٠ شوال سنة ١٢٦٣ هـ — ١٨٤٧ م وصل الخبر إلى الضبطية بظهور حريق فى الساعة الرابعة من ليلة ٢٧ رمضان الماضى فى منزل على الزيات بباب الشعرية ، فأرسلت الضبطية ما لزم من الطلمبات والطلومبجية ، وحصل تدارك الحريق بطلومبة الخط المذكور أيضاً ، فحصل إخمادها سريعاً ، ولكنه نفق بسببها بقرتان وثوران وحمار .

ونشرت فى العدد الصادر فى ١٧ شوال سنة ١٢٦٣هـ — ١٨٤٧م أن مخزن الليف ببولاق ملك الشيخ محمد صقر ، ظهرت به حريقة فى الساعة الثانية من يوم الجمعة الموافق نهاية الشهر الماضى ، ولما وصل خبره إلى الضابطخانة أرسلت من طرفها ومن طرف الطلومبخانة بعض الطلمبات مع مأموريها وبذلوا

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(١) المقريزى المواعظ والاعتبار بذكر الخطط والآثار ج ٢ ص ١٠٣ .

جهدهم الزائد مع الطلمبجية المختصين ببولاق ، فأخمدوها ، ولم يحترق سوى جانب من ليف كان موجودا بالمخزن[1] .

وفى فبراير سنة ١٨٧٥ م تحرر من وزارة الخارجية إلى الحكومة الانجليزية بطلب انتداب اليوزباشى شو رئيس فرقة المطافىء بلوندرة ، لاستشارته فى الإجراءات التى تتخذ ضد الحريق ، وتنظيم فرقة المطافىء بالقاهرة ، والإقامة لهذا الغرض بضعة أيام للإدلاء برأيه فى هذا الشان[2] .

وكان الإطفاء بواسطة آلات تدار بالبخار ، تجرها جياد دربت أحسن تدريب كانت تتحرك من أماكنها بمجرد سماعها جرس الحريق وتقف فى مكانها من سيارة الإطفاء ، وظلت مستعملة إلى أن استبدلت بسيارات الإطفاء فى سنة ١٩٢٠ .

تسمية الشوارع وترقيم الدور

عهدنا بالشوارع والحارات والرحاب فى القاهرة أن تطلق عليها أسماء التجارات والصناعات التى تشغلها ، كما أطلق عليها أسماء بعض القبائل والأفراد كما هو واضح ومدون فى أول الجزء الثانى من خطط المقريزى ، وما هو وارد فى الحجج القديمة .

وفى سنة ١٨٤٧ م وبعد أن نظمت القاهرة وشقت فيها الشوارع ، وغرست بها الأشجار وأضيئت ، رؤى تسمية الشوارع وترقيم الدور ، فصدر الأمر بذلك فى سنة ١٢٦٢ هـ — ١٨٤٧ م مستهلا بتلك الديباجة :

«لما كانت كتابة أسماء الأزقة بمصر المحروسة على محل يناسبها فوق زواياها ، وتنمير البيوت الكبيرة والصغيرة برقم نمرها بأعلى أبوابها أو بجانبها ، كأسلوب أوروبا ، مما يستوجب المنافع العظيمة للمملكة ، ويورث السهولة لمن يقصد زقاقاً أو بيتاً ، سواء كان من الأهالى أو من الأجانب ، استقر الرأى بمجلس

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(١) الوقائع المصرية عدد رقم ٨٣ سنة ١٢٦٣هـ — ١٨٧٤ .
(٢) إسماعيل كما تصوره الوثائق ص ١١٧ .

فعم النفع به . وسلكه المسافرون بعد ما كان يتعذر المرور فيه أيام فيضان النيل لغمره بالماء .

الاضاءة

كانت الإضاءة تعم الشوارع والحارات فى الفسطاط ثم فى القاهرة ، ذلك أنه فى سنة ٣٨٣ هـ — ٩٩٣ م أمر الخليفة العزيز بالله باضاءة المصابيح على الدور وفى الأسواق(١) . وفى ذى الحجة سنة ٣٩١ هـ — ١٠٠٠ م أمر الحاكم بأمر الله أن توقد القناديل فى سائر البلد على جميع الحوانيت وأبواب الدور والمحال والسكك الشارعة وغير الشارعة ، فنفذت أوامره . ولازم الحاكم بأمر الله الركوب فى الليل ، وكان ينزل كل ليلة إلى المدينة متفقداً شوارعها وأخطاطها وأزقتها ، فتبارى السكان فى الإضاءة ، وزينت القياسر والأسواق بأنواع الزينة (٢) .

ولم تكن الإضاءة قاصرة على الدور والشوارع والحوانيت ، بل ألزم بها المشاة ، فكل إنسان يحمل فانوساً يضىء له ، ومنها الصغير للفرد والكبير يسير به الضوى أمام سادته . هذا عدا المشاعل التى تتقدم المواكب .

والطريف فى أمر الإضاءة فى المواكب ما اتخذ منها لمنع التصادم ومنع الخطر فى الليل ، وأول من حمل الشمع معه على البغال فى الليل محمد بن طغج الأخشيد منذ عشرة قرون ونصف . فكانت الشمعة تحمل على مؤخر البغل وفراش راكب أمامها يلتفت إليها بين آونة وأخرى يصلحها أو يضيئها ، ولاشك فى أنه كان يسير فى مؤخر الركب ، بل وفى مقدمته أيضاً (٣) .

ومنذ ذلك الوقت شاع استعمال الفوانيس التى تحمل على البغال مع الفانوسية أمام وخلف ركب الملوك فى الليل . وظلت أوامر الإضاءة على الدور والأسواق منفذة على سكان مصر تصدر بشأنها الأوامر بين آونة وأخرى(٤) ، إلى أن كان

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(١) المواعظ والاعتبار بذكر الخطط والآثار للمقريزى ج ٢ ص ١٠٨ .
(٢) المواعظ والاعتبار بذكر الخطط والآثار للمقريزى ج ٢ ص ١٠٨ .
(٣) صبح الأعشى ج ١ ص ٤١٦ .
(٤) عجائب الآثار للجبرتى ج ٣ ص ٤١

عهد الحملة الفرنسية بمصر سنة ١٢١٣ هـ — ١٧٩٨ م فانهم أمروا بابطال القناديل التى كانت توقد فى الليل على الدور والدكاكين . وأن يوقدوا عوضاً عنها فى وسط السوق مجامع فى كل مجمع أربع قناديل ، وبين كل مجمع ٣٠ ذراعاً ، يقوم بذلك الأعيان دون الفقراء ، ثم عادت الإضاءة إلى نظامها القديم .

مكافحة الحريق

كان فى مدينة الفسطاط فى عهد والى مصر عبد العزيز بن مروان ، فرقة إطفاء مكونة من خمسمائة عامل لمكافحة حريق طارئ فى البلد(١) أو هدم ، ولقد شملت أوامر الإضاءة أمام الدور والدكاكين منذ الدولة الفاطمية ضرورة وضع زير مملوء بالماء أمام كل حانوت مخافة حدوث حريق فى مكان فيطفأ بسرعة (٢) .

ولما كثرت الحرائق فى سنة ٤٠٥ هـ — ١٠١٤ م أمر الحاكم بأمر الله باتخاذ القناديل على الحوانيت وأزيار الماء مملوءة ، وإزالة السقائف التى على أبواب الحوانيت والرواشن التى تظلل الباعة فنفذت أوامره بالفسطاط والقاهرة (٣) .

وفى سنة ٥١٧ هـ — ١١٢٣ م أمر الوزير المأمون الواليين بمصر والقاهرة ، باحضار رؤساء السقائين وأخذ التعهدات عليهم باستعدادهم للحضور كلما دعت الحاجة إليهم ليلا ونهاراً . ورتب عدداً من العتالين كى يبيتوا على باب كل معونة (مركز الشرطة) مع عشرة من الفعلة ومعهم الطوارق والقرب مملوءة بالماء . على أن تتكفل الحكومة بنفقاتهم (٤) .

وبمناسبة الحرائق التى حدثت بمصر والقاهرة سنة ٧٢٠ هـ — ١٣٢٠ م نودى فى القاهرة بوضع زير أو دن مملوء بالماء عند كل حانوت ، وأن يقام مثل ذلك فى الحارات(٥) والأزقة .

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(١) المقريزى المواعظ والاعتبار ج ٢ ص ١٧٨ .
(٢) المقريزى المواعظ والاعتبار ج ٢ ص ١٠٧ .
(٣) المقريزى المواعظ والاعتبار ج ٢ ص ١٠٨ .
(٤) المقريزى المواعظ والاعتبار ج ١ ص ٤٦٣ .
(٥) المقريزى المواعظ والاعتبار ج ٢ ص ٥١٤ .

من تجميل المدينة وتلطيف الجو ، صدرت الأوامر بغرسها على حافتى طريق الرميلة وقره ميدان[١] .

التغييرات الجوية

وكانت تصدر نشرة عن الظواهر الجوية فى الوقائع المصرية تحت عنوان (ميزان هواى مصر) .

ظهرت لأول مرة فى الوقائع المصرية الصادر فى غاية ذى القعدة سنة ١٢٤٤ هـ ١٨٢٩ م .

مجلس للاشراف على تجميل القاهرة

فى ٨ ذى الحجة سنة ١٢٥٩ — ديسمبر سنة ١٨٤٣ م ، صدر أمر بانشاء مجلس للإشراف على تزيين وتجميل المحروسة ، وتعديل طرقها ، أسوة بما استحدث فى الإسكندرية ، وهذا المجلس مؤلف من :[٢] رشيد افندى مفتش الأبنية الأميرية ، لينان افندى مهندس القناطر ، مصطفى بهجت رئيس قلم الهندسة بديوان المدارس .

مجلس تنظيم المحروسة

ورد ذكر هذا المجلس سنة ١٢٦٤ هـ — ١٨٤٧ م فى الأمر الصادر بترقيم الدور وتسمية شوارع المحروسة .

وفى ٥ شعبان سنة ١٢٨٤ هـ — ٢ ديسمبر سنة ١٨٦٧ م ، صدر أمر بتشكيل مجلس بلدى وفصل إيراد مدينة القاهرة ومصروفها من نظارة المالية ، وإسناد إدارتها إلى هذا المجلس ليعمل على تنظيم المدينة ، وليكون له الحق فى تنظيم ميزانيته ، وصرف ما يراه مناسباً للأعمال النافعة ، شأنه فى ذلك شأن المجالس البلدية فى سائر الممالك[٣] .

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(١) الوقائع المصرية عدد ٩٧ بتاريخ ٢٠ محرم سنة ١٢٦٤ .

(٢) دفتر ٢٠٩١ ورقة ١٤ ديوان المدارس .

(٣) إسماعيل كما تصوره الوثائق الرسمية ص ١١٦ .

من ذلك الوقت أخذت الحكومة فى الإشراف بنفسها وعلى نفقتها القيام بأعباء كل تلك الأعمال .

كورنيش النيل

وعلى ذكر العناية بالنيل ، وتنفيذ عمل الكورنيش عليه من حلوان إلى القناطر الخيرية ذلك العمل الخالد فى تاريخ مصر الحديث . وأنصع صفحة من صفحات حكومة الثورة العمرانية . أذكر أن النيل كان موضع الرعاية والاهتمام بترك شاطئه خالياً من البناء ، ولكنهم قديماً صبغوا قوانين تخليته بصبغة دينية ، فحذروا الناس من السكنى على شاطئه مباشرة ، وقالوا : إن الجالس على النيل كالجالس على الطريق[١] ، لأن البحر طريق للمرور فيه بالمراكب ، وذلك منعاً لكشف عورات المسلمين ، وللبعد عن سماع فحش الكلام من النوتية وغيرهم ، صوناً للبنات والنساء .

ثم ذكروا أن العلماء نصوا على أن حرم العيون خمسمائة ذراع ، وحرم الأنهار ألف ذراع .

وفى أخريات سنة ٧٠٨ هـ — ١٣٠٨ م أمر الملك المظفر ركن الدين بيبرس الجاشنكير باقامة جسر على النيل من القاهرة إلى دمياط ، وذلك حينما وصلت إليه الأخبار بأن ملك قبرص تآمر مع غيره من ملوك الفرنج على غزو دمياط ، فاجتمع الأمراء واتفقوا على تنفيذ الجسر من القاهرة إلى دمياط . خشية أن تكون حركة الفرنج فى زيادة النيل فيتعذر الوصول إلى دمياط ، وعهد إلى الأمير آقوش الرومى بتنفيذه . فكتب الأمراء إلى بلادهم بخروج الرجال مع الأبقار كل فى منطقته ، وصدرت الأوامر إلى الولاة بمساعدة الأمير آقوش بالرجال والأبقار . فسارت الأعمال بهمة خارقة ، حيث عمل فى تنفيذه ٣٠٠ جرافة بستمائة رأس بقر ، وثلاثين ألف رجل ، إلى أن فرغ فى نحو شهر واحد ، فكانت المسافة من قليوب إلى دمياط تقطع فى يومين . وعرض الطريق من أعلاه أربع قصبات ومن أسفله ست قصبات يسير فيه ستة رؤوس من الخيل صفا واحداً .

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(١) المدخل لابن الحاج ج ١ ص ٢٤٦ ـــ ٢٤٨ .

«يؤذن بالقرار الصادر بشأن خرائب القاهرة التى أحصتها اللجنة برئاسة أمين أفندى ، وعضوية الباشمهندس الحاج مصطفى قوله ، والشيخ حسن أبو صفيحة مندوب المحكمة الشرعية ، والتى تبين من إحصائها أن عـدد الخرائب بأقسام البوليس السبع [1] بالقاهرة بلغ ٢٥٨ خرابة ليس فى مقدور مالكيها القيام بترميمها ، فهذا القرار يعرض بأن تقسم هـذه الخرائب إلى قسمين قسم تراه الحكومة لازماً لها فتأخذه وتعمره ، والقسم الآخر تتخذ الإجراءات اللازمة لبيعه لمن حوله من الجيران الموسرين الذين يستطيعون بناءه وتشييده » .

هذا ما يتعلق بالأعيان المملوكة ، أما الأعيان الموقوفة فقد صدر بشأنها أمر فى سنة ١٢٤٧ هـ — ١٨٣١ م نصه :

« يؤذن بقراره الصادر بشأن ٩٧٨ عيناً من عقـارات الأوقاف كانت لجنة إحصاء خرائب القاهرة ذكرت فى تقريرها أن نظار الأوقاف التابعة لهم أخذوا على عهدتهم أن يرمموها [2] .

وبمـا أن معظم هذه المحال لم تمسها يد الإصلاح إلى الآن ، فالمجلس يرى وجوب قيدها فى الديوان الخديوى ، مع إرغام نظارها على الوفاء بعهـدهم ، على أن لايضن عليهم بتقديم المعونة اللازمة من قبل ناظر الأبنية الأميرية .

وفى سنة ١٨٣٧ م صدر قانون بمعاينة المساكن الآيلة إلى السقوط وإزالتها هى والحيشان والدور المتخربة المستعملة كزرايب ومستودعات للقاذورات ، والتنبيه على أصحابها ببنائها مساكن ، وذلك فى ظرف ثلاثين يوماً ، وإلا عرض العقار للبيع ، فان لم يتقدم مشتر اشترته الحكومة ، وإن كان تابعاً لوقف تنبه على ناظره بالبناء ، فان لم يستطع يصير استبداله [3] .

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(١) وثيقة رقم ٨٦ (١٩ ربيع الآخر سنة ١٢٤٧) دفتر تركى ٧٨٤ .
(٢) وثيقة رقم ١٩١ (١٩ ربيع الآخر سنة ١٢٤٧) .
(٣) تاريخ الادارة الصحية فى مصر ص ٣٨ — ٣٩ .

إزالة الـكيمان وغرس الأشجار

وفى سنة ١٨٢٩ م أزيلت الـكيمان المجاورة للقصر العالى (جاردن سيتى) والمعروفة بكوم العقارب ، وكان مسطحها تسعة أفدنة ، فأزيلت فى ٣٩٣ يوماً .

وكذلك أزيلت التلال فيما بين الناصرية وجاردن سيتى ومساحتها ٣٨ فداناً وغرست بأشجار الزيتون وغيرها [1] .

وكذلك أزيلت الأكمة ، التى كانت تسد الطريق إلى شبرا ، بجوار قنطرة الليمون وحولت إلى متنزه عام [2] .

وفى سنة ١٤٨٦ استعجل الأمر الصادر بتوسيع أزقة وفتح شوارع الموسكى وقطع كوم سلامة ، وشوارع بولاق وفم الخليج والقلعة [3] .

وفى سنة ١٢٦٠ هـ — ١٨٤٧م حولت المنطقة عند كوبرى الليمون إلى متنزه عام غرست فيه أنواع الزهور والأشجار [4] .

وفى سنة ١٢٦٣ هـ — ١٨٤٧ م شرع فى توسعة الشارع من باب الحديد إلى الظاهر ، والمتصل بطريق السويس [5] ، كما أجرى توسيع شوارع درب الجماميز ، وباب الخلق ، والمشهد الحسينى ، ثم غرست الأشجار فى الشوارع ، ومهد طريق متسع بين مصر وشبرا غرست على جوانبه أشجار الجميز واللبخ ، كان من أجمل متنزهات مصر .

وكذلك ردمت بركة الأزبكية وحولت إلى متنزه عام[6] .
ثم غرست الأشجار على جانبى الشوارع الكبيرة . وحينما ظهرت آثارها

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(١) الوقائع المصرية رقم ١١٤ (٢ رمضان سنة ١٢٤٥) .
(٢) تقويم النيل ج ٢ ص ٥٣٢ .
(٣) الوقائع المصرية .
(٤) الوقائع المصرية .
(٥) الوقائع المصرية عدد ٧٥ (١٣ شعبان سنة ١٢٦٣) .
(٦) الوقائع المصرية رقم ٨٩ فى ٢٣ ذى القعدة سنة ١٢٦٤ .

ونشرها تباعاً فى تسع مقالات فى مجلة المجمع العلمى العربى بدمشق ، بدأها فى الجزأين السابع والثامن من المجلد الثامن عشر (جمادى الآخرة ورجب سنة ١٣٦٢ هـ — ١٩٤٣ م) ، وانتهى منها فى المقال التاسع المنشور فى الجزأين السابع والثامن من المجلد العشرين سنة ١٩٤٥ .

تجميل القاهرة

من تلك الأخبار نقف على أمر هام ، وهو أن العناية لم تقتصر على تعبيد الطرق وتمهيدها بالقاهرة ، بل تعدتها إلى تجميلها ، مما دعاهم أيضاً إلى ستر الخرائب عن العيون ، كما نفعل الآن بوضع لوحات الإعلانات عليها .

ذلك أنه لما استولى الخراب فى زمن المستنصر بالله أمر الوزير أبو محمد اليازورى ببناء جدار يستر الخرائب عن نظر الخليفة الفاطمى حينما يتوجه من القاهرة إلى الفسطاط ، وذلك فيما بين العسكر والقطائع ، وكذلك أقام جداراً آخر عند جامع أحمد بن طولون (١) .

وفى خلافة الآمر بأحكام الله عهد إلى وزيره أبى عبد الله محمد بن فاتك بتعمير الخرائب والفضاء فيما بين باب زويلة والسيدة نفيسة ، فنادى فى القاهرة وأمر بأن من كانت له دار فى الخراب أو مكان يعمره ، ومن عجز عن عمارته يبيعه أو يؤجره من غير نقل شىء من أنقاضه ، ومن تأخر بعد ذلك فلا حق له فى شىء منه ، ولا حكر يلزمه . فعمرت الخرائب وأصبحت المنطقة عامرة ، وأصبحت القاهرة لاتتخللها خرائب(٢) .

وكذلك نقلت أنقاض مدينة العسكر ومهدت ، فصار الفضاء فيما بين السيدة نفيسة إلى كوم الجارح (وهى المنطقة التى مهد جزء من كيمانها . والمعروفة بتلال زين العابدين .

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(١) المواعظ والاعتبار بذكر الخطط والآثار ج ٢ ص ٢٠ .
(٢) المواعظ والاعتبار بذكر الخطط والآثار ج ٢ ص ٢٠ .

ولأهمية بركة الفيل باعتبارها من أجمل متنزهات القاهرة ، عنى الناصر محمد بن قلاوون ، بتجميلها والمحافظة على رونقها ، فأمر فى النصف الأول من القرن الرابع عشر الميلادى ، باقامة حائط بطولها (١) ليحجب الأجزاء التى لم تعمر من جهة الجسر الأعظم .

فرش الرمل الأصفر

وعلى ذكر تجميل القاهرة أذكر أن مصر عرفت فرش الرمل الأصفر فى حفلاتها الرسمية منذ ألف عام ، فقد كان نظام حفلات الاستقبال فى الدولة الفاطمية يقضى بفرش الرمل فى الطريق المؤدى إلى القصر الفاطمى(٢) وأمامه ، وهذا ماكان متبعاً بمصر إلى وقت قريب جداً .

ظلت العناية بتعبيد الطرق ، وإصلاحها وتجميلها موكولة إلى سكان القاهرة حتى عنيت بها الحكومة وأصدرت أوامرها فى سنة ١٨٤٨ م ، بتعيين أربع بلوكات من ديوان الجهادية للقيام بتسوية وتمهيد الطرقات والشوارع فى كل من نواحى الموسكى ، والأزبكية (٣) وبولاق .

القضاء على الخرائب

وكذلك وجهت العناية إلى إزالة الدور المتخربة ، والقضاء على الخرائب التى تشوه القاهرة ، فصدرت الأوامر فى سنة ١٨١٦م باعداد تجريدة من المهندسين للكشف على دور القاهرة ، فان وجدوا بها خللا أمروا باصلاحه أو هدمه ، وذلك على أثر (٤) سقوط منزل .

وتعجيلا لعمرانها والقضاء على خرائبها ، صدر قرارآخر بتعمير الخرائب ، سواء أكانت مملوكة أم موقوفة ، وذلك فى سنة ١٨٣١ م بعد إحصائها جاء فيه :

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(١) المواعظ والاعتبار بذكر الخطط والآثار ج ٢ ص ١٦٥ .
(٢) المواعظ والاعتبار للمقريزى ج ١ ص ٤٣٣ .
(٣) الوقائع المصرية العدد ١٠٦ الصادر فى ٢٣ ربيع الأول سنة ١٢٦٤ هـ .
(٤) عجائب الآثار للجبرتى ج ٤ ص ٢٥٣ .

تمهيد الطرق

لم تقف العناية عند تنظيم الطرق وتوسعتها ونظافتها ، بل شملت تمهيدها وتعبيدها حتى يمكن السير والجر عليها ، فقد كان عمر بن الخطاب يعهد إلى أهل الذمة باصلاح الجسور والطرق [١] كما ثبت أن عبد العزيز بن مروان فى ولايته على الفسطاط سنة ٦٥ هـ — ٦١٤ م اهتم بتعبيد الطرق ، وأعد لها الأدوات اللازمة ، ليمكن السير والجر عليها [٢] وكذلك تضمنت التعليمات التى كانت تصدر إلى والى الفسطاط عند تعيينه [٣] ، التشديد على نظافة المسالك والساحات ، ومنع توعير السبل ، والطرقات ، وكانت الدول الإسلامية المتعاقبة على حكم مصر تقوم بين آونة وأخرى ، بتمهيد الطرق وقطع ماارتفع منها [٤] باعتبار ذلك من الأعمال الرئيسية للدولة .

وقد بلغ من الاهتمام بتنظيم الطرق وإعدادها وتنسيقها ، احتساب الاهتمام بها من حسنات الملك أو الوالى المهتم بها . كما ورد فى ترجمتى الأمير منجك [٥] اليوسفى والملك [٦] الأشرف أينال ؛ فقد عد من حسناته أنه وسع شارع بين القصرين .

وفى القرن التاسع الهجرى ، الخامس عشر الميلادى ، اشترك والى الشرطة مع المحتسب فى تنفيذ تلك الأوامر ، فكان يلزم سكان الدور والحوانيت بتمهيد الطريق أمامهم [٧] .

وممن لهم أثر مشكور فى العناية بالطرق ، الأمير يشبك من مهدى دوادار الملك الأشرف قايتباى ، فانه فى سنة ٨٨٢ هـ — ١٤٧٨م شرع فى توسعة الطرق

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(١) التراتيب الادارية ج ١ ص ٢٨٣ .
(٢) التراتيب الادارية ج ١ ص ٢٨٤ .
(٣) صبح الأعشى ج ١ ص ٣٣٦ .
(٤) المقريزى ج ٢ ص ١٠٧ (كتاب المواعظ والاعتبار بذكر الخطط والآثار) .
(٥) المنهل الصافى لابن تغرى بردى ج ٣ قسم ٣ ص ٣٦٧ .
(٦) الضوء اللامع للسخاوى ج ٢ ص ٣٢٩ .
(٧) التبر المسبوك فى ذيل السلوك للسخاوى ص ٣٦ .

والشوارع والأزقة ، وخاصة الشارع الرئيسى للقاهرة من باب الفتوح إلى باب زويلة ، وتبييض الدكاكين ووجهات الربوع ، وعهد إلى القاضى فتح الله السوهاجى أحد نواب الشافعية ، بأن يحكم بهدم ماوضع فى الشوارع والأسواق بغير طريق شرعى ، من أبنية ، وسقائف ، ورواشن ، ومساطب [١] واستمرت تلك العملية إلى سنة ٨٨٣ هـ — ١٤٧٩ م حيث أمر أيضاً باصلاح وجهات المساجد ، وطلاء رخامها ، فحصل بذلك نفع كبير .

وكان لتوسيع الطرق وتمهيدها أثر كبير فى الكشف عن وجهات المساجد المطلة على الشارع الرئيسى (المعز لدين الله) . وعين للإشراف على تنفيذ تلك الأعمال ، ملاحظاً للطرق [٢] . كان يستحث الناس على سرعة إنجاز أعمال البياض والدهان ، حتى صارت القاهرة كأنها مستجدة البناء والزخرف ، وكذلك اهتم بتجميل شوارع القاهرة السلطان الناصر [٣] أبو السعادات محمد بن الأشرف قايتباى ، فانه أمر فى سنة ٩٠٤ هـ — ١٤٩٨ م بأن ينادى فى القاهرة بأن جميع أصحاب الحوانيت التى بالأسواق والشوارع يبيضون وجوهها ، ويزخرفونها بالدهان ، ثم أمر بتبييض وجوه الرباع المطلة على الشوارع .

وكذلك اهتم السلطان الغورى بتمهيد الطرق وتعبيدها . فألزم السكان بالقيام بهذا العمل فى سنة ٩٠٩ هـ — ١٥٠٣ م [٤] .

وإلى سنة ١٢٣٣ هـ — ١٨١٧م كانت الحكومة تلزم السكان بتمهيد الطرق ، إذ فى هذه السنة كلف بهذه المأمورية مصطفى أغا المحتسب ، فنادى فى المدينة وأمر الناس بقطع أرضية الطرقات والأزقة حتى العطف والحارات الغير نافذة [٥] .

ولم تغفل كتب اللغة شؤون الطرق ، فعالجت مسمياتها فى معاجمها ، وقد عكف على جمعها الباحث المدقق السيد سليم الجندى وسماها « رسالة الطرق »

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(١) ابن اياس ج٢ ص١٧١ —١٧٧ ، النزهة السنية فى ذكر الخلفاء والملوك المصرية ص ١٣٥ .
(٢) تاريخ مصر لابن إياس ج ٢ ص ١٧٧ .
(٣) تاريخ مصر لابن اياس ج١ ص ٣٤٦ .
(٤) تاريخ مصر لابن اياس ج ٤ ص ٥٩ .
(٥) عجائب الآثار فى التراجم والأخبار للجبرتى ج ٤ ص ٢٩٠ .

فجمعوهم بخان السبيل بالحسينية (١) ، ثم نقلوهم إلى الفيوم ، وأفردت لهم بلدة تغل للصرف عليهم بما يكفيهم ، وأراحوا الناس من مضايقاتهم ، غير أنهم لم يستقروا بها وتفرقوا ، ورجع كثير منهم إلى القاهرة .

والعناية بالفقراء ووقايتهم شر السؤال موجودة فى جميع أدوار التاريخ منذ فجر الإسلام ، ومنذ الدولة الفاطمية انشئت الربط لإيواء الفقراء من الرجال والنساء ، وما خصص منها للنساء كان بمثابة دور كفالة للمرأة ، وكان للنساء فضل إنشاء الكثير منها فى دولتى المماليك ، إلى القرن الثامن عشر ، وكانت تلك الربط تؤوى النساء الفقيرات والعجائز والأرامل والبنات حتى يتزوجن ، والمطلقات حتى يعدن إلى أزواجهن أو يتزوجن .

وكان يختار لرآسة تلك الربط ، سيدات اشتهرن بالعلم والحزم لتعليم المقيمات بها وصيانتهن ، وإلى الآن ما زالت بقايا تلك الربط موجودة « كرباط خوند زينب بالخرنفش » .

وكثيراً ما كانت الحكومات تجمع المتسولين إذا لاحظت عليهم تمرداً دعاها ذلك إلى مكافحتهم بشتى الوسائل ، ذلك أنه فى سنة ٧٧١ هـ — ١٣٦٩ م أمر السلطان شعبان بجمع المتسولين وتوزيعهم على الأمراء والتجار لإعالتهم ، كل حسب مقدرته وثرائه ، ونودى فى القاهرة بعد ذلك أن لايتصدق أحد على متسول (٢) .

وفى سنة ١١٠٦ هـ — ١٦٩٤ م وقع غلاء بمصر ، فعزت الأقوات على الفقراء فاهتم بهم اسماعيل باشا والى مصر ، فجمع الفقراء والمتسولين ووزعهم على الأمراء والتجار للإنفاق عليهم ، وخص نفسه بجانب منهم ، إلى أن انقضى الغلاء (٣) .

وفى ٢٣ جمادى الثانية سنة ١٢١٥ هـ — ١٨٠٠ م صدرت الأوامر بجمع المتسولين وخصصوا أماكن لإقامتهم ، وعهدوا إلى نظار الأوقاف بالصرف عليهم (٤) .

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(١) السلوك لمعرفة دول الملوك ج ١ قسم ٢ ، ص ٥٥٣ والتحفة الملوكية ص ١٩ .
(٢) عقد الجمان فى تاريخ أهل الزمان للعينى ج ٢٤ قسم ٢ ص ١٨٣ .
(٣) تقويم النيل ج ٢ ص ٦٥ .
(٤) عجائب الآثار للجبرتى ج ٣ ص ١٣٨ .

وفى أوائل القرن التاسع عشر جمع الغلمان المشردون وألحقوا بالمصانع المنشأة وقتئذ .

مكافحة المناظر المحزنة والدجالين

وكذلك وجهت العناية إلى مكافحة المناظر المحزنة والدجالين التى تخالف تعاليم الدين فكان المحتسب منذ الدولة الفاطمية يمنع النساء من الخروج خلف الجنازات كاشفات وجوههن ورؤسهن ، ويعاقب النائحات إلى حد النفى (١) .

وفى سنة ٨٢٤ هـ — ١٤٢١ م منع المحتسب النساء من النياحة على الأموات (٢) .

وفى شوال سنة ٩١٠ هـ — ١٥٠٤ م أمر السلطان الغورى بأن ينادى فى القاهرة بأن لايعمل عزاء بطارات ، ولا نائحة تنوح على ميت . ثم أوعز إليه على نائحة عملت عزاء بطارات ، فقبضوا عليها ، ولطخوا وجهها بالسواد وعلقوا طاراً فى عنقها وأركبوها حماراً ، وشنعوا عليها فى أنحاء القاهرة . وكان هذا سبباً فى إقلاع النساء عن تلك العادات (٣) .

وكذلك كافحوا الدجالين الذين ينصبون على النساء ويغررون بهن . فقد صدرت أوامر الناصر محمد بن قلاوون سنة ٧٣٣ هـ — ١٣٢٣ م بالقبض على المنجمين وتسليمهم إلى والى القاهرة ، فضربوا وحبسوا ، ومات منهم تحت العقوبة أربعة (٤) .

ومن ذلك ما فعله الأمير عبد الرحمن كتخدا سنة ١١٧٣ هـ من ذبحه للعنزة التى كان يدجل بها الشيخ عبد اللطيف خادم السيدة نفيسة ، وتوبيخه والتشهير به بوضع جلدها على عمامته وطوافه بالقاهرة وسط الطبول والأشاير (٥) .

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(١) معالم القربة فى أحكام الحسبة ص ٥١ .
(٢) نزهة النفوس والأبدان ص ١٠٣ (خط) .
(٣) ابن اياس ج ٤ ص ٧٦ .
(٤) البداية والنهاية ج ١٤ ص ١٦١ .
(٥) عجائب الآثار ج ١ ص ٣٦٢ .

وكذلك وجدت وقفيات يصرف منها على تعديل الطرق ورصفها[1] ذكرها ابن بطوطة عند ذكر الأوقاف بدمشق بقوله :

« ومنها الأوقاف على تعديل الطرق ورصفها، لأن أزقة دمشق لكل واحد، منها رصيفان فى جنبيه يمر عليهما المترجلون ، ويمر الركبان بين ذلك .

النظافة

ويدخل فى اختصاص المحتسب منذ إنشاء القاهرة ، الإشراف على النظافة ومنع إلقاء القمامة فى الشوارع، وعدم الإفراط فى رش الماء مما يتسبب منه الزلق. كما يلزم الملاك بازالة الأوحال من امام دورهم ومحالهم . ويمنع هز المون وسط الطريق أو ترك مخلفات العمارة، ويشدد على أصحاب الأسواق بكنسها ورشها[2] ومداومة نظافتها ، ومنع طرح القمامة بجوار الطرق .

أما المساجد فقد رصد فى وقفيتها مبالغ تصرف لمن يقوم بالنظافة والرش أمامها وحولها . وهذا ماتضمنته وقفية الغورى[3] فقد رصد فيها مرتب للكناس والرشاش للطرقات تجاه بابى المدرسة ، وحول القبة والخانقاه .

كذلك يحتم على ناقلى السماد إحكام تغطيته عند نقله ، حتى تنقطع رائحته فلا يتأذى الناس منها، ويأمر بمنع ربط الدواب فى الطريق حتى لاتعوق السير.

وإلى سنة ١٢٢٩هـ — ١٨١٣م كان والى القاهرة وأعوانه من الشرطة يمرون فى الشوارع والأسواق ملزمين السكان والتجار بنظافتها ورشها[4] .

ظل المحتسب يشرف على تنفيذ أوامر النظافة إلى أن أنشئت أقسام البوليس فى أوائل القرن التاسع عشر ، وأذيع على أقسام البوليس ورؤسائها ومشايخ الأقسام التعليمات الواجب عليهم اتباعها والمنشورة فى الوقائع المصرية الصادرة فى ١٧ صفر سنة ١٢٤٦ هـ — ١٨٣٠م وقد جاء فيها :

(١) رحلة ابن بطوطة جـ ١ ص ٦٠ .
(٢) معالم القرية ص ٧٩ .
(٣) الخطط الجديدة جـ ٥ ص ٦٣ .
(٤) الجبرتى جـ ٤ ص ٢٠٤ .

« ينبغى عند صبيحة كل يوم أن يقوم أهل الأسواق بكنس ورش المنطقة أمام دكاكينهم وأن سكان المنازل يكنسون ويرشون أمام بيوتهم ، فاذا ضبط مندوب أميرالاى المحروسة أناساً يلقون القاذورات ، يضربهم ضرباً خفيفاً ، ويحذرهم من العودة إلى ذلك ، وعلى أقسام البوليس تأديب من يتأخر عن النظافة أمام بيته أو دكانه ؛ ويجب المناداة بذلك والتنبيه على مشايخ الحارات بمراقبة التنفيذ .

أما المنشآت الحكومية ، فينبه على نظارها بالإشراف على نظافة ماحولها . وما يكون حول القلعة يكلف بنظافته سقّا باشى القلعة .

ويقوم بنظافة المحلات الخربة سقّا الحارة ، وأجرته على الموسرين من السكان.

وفى سنة ١٨٣١م عينت الحكومة الموظفين لمراقبة النظافة ومراقبة تنفيذ[1] تلك التعليمات ، كذلك حددت أماكن لإلقاء الأتربة (المقالب) ، فلا يلقى فيها إلا باذن . كما حددت أماكن لإيداع القمامة تودع فيها إلى أن تنقل وتلقى فى البحر ، وهذا ماحدده الأمر الصادر من مجلس الملكية فى ٧ ذى الحجة سنة ١٢٤٩ هـ — ١٨٣٣ م وقد أذن بخروج الأتربة المخلفة من عمارات قصور قنطرة الدكة ، والأزبكية من أبواب القاهرة ، المعتاد إخراج الزبالة وفضلات القاهرة منها ، إلى خارج المدينة .

وأن يأمر كذلك ناظر الترسانة باتمام إنشاء القوارب اللازمة لنقلها إلى خارج المدينة ، والتى تجمع بشونة المسكنة بساحل البحر إلى البحر الأبيض المتوسط مراعاة للصحة العامة[2] .

مكافحة التسول

لم يكن الاهتمام بالقاهرة قاصراً على نظافتها من القاذورات، بل شمل نظافتها من المناظر المنفرة ، فقد كوفح أصحاب العاهات ومفتعلوها ، ذلك أنه فى سنة ٦٦٤ هـ ١٢٦٥ م ، أمر السلطان الظاهر بيبرس البندقدارى بجمع أصحاب العاهات ،

(١) تاريخ الإدارة الصحية ص ٣٦ .
(٢) وثيقة رقم ١٨ دفتر ٧٩٦ ديوان خديوى .

وكذلك تناول المشرع الإسلامى قوانين سعة الشوارع والطرق ، وتناولها فى أحكامه . واتفقوا على أن الطريق النافذ مباح المرور فيه لكل إنسان لأنه حق للمسلمين ، فليس لأحد أن يبنى فيه أو يخالف خط جاره (خط التنظيم فلا[1] يبرز عنه ، كما وضعوا قوانين لإقامة الأسبطة[2]، واشترطوا أن تكون مرتفعة بحيث يمر المحمل ، أو الفارس على جواد ورمحه قائم ، وحرموا بناء المساطب وغرس الأشجار أمام الدور، ما دام يترتب على غرسها تضييق الطريق) .

ووضعوا فى حكم المنافع العامة الشوارع الخاصة التى أبيح استعمالها ، ومثلها الشوارع التى اصطلح الملاك على تركها من أملاكهم ، والطرق التى تشقها الدولة ، فلا يجوز شغلها ، ولا تضييقها صوناً لنقوش الجدران فى وجهات المساجد والدور ، وتيسيراً للمرور ، ولتوفر الهواء والنور، شددوا على سعة الشوارع .

وقد تركوا الحرية لمن ينشىء شارعاً خاصا ، ولكنهم فضلوا أن يكون متسعاً على أن لا يقل عن سبعة أذرع .

وفى مشروعات نزع الملكية ، لتوسيع الشوارع والحارات ، ولتوسيع المساجد ، اتبعت طريقة المفاوضة مع المالك ، فاذا لم يتم الاتفاق يودع الثمن المقدر فى بيت المال ، ويستولى على العقار [3] وهو ما نتبعه الآن .

على ضوء هذه القوانين، وما استجد بعدها تبعاً لتدرج العمران ، وضعت القوانين الخاصة بتنظيم الطرق ، وإزالة ما يعترضها ، وحددت سلطة المحتسب الذى يقوم بتنفيذها .

والحسبة قانون مدنى ، فيدخل فى اختصاص المحتسب وأعوانه حمل الناس على المصالح العامة فى المدينة، وقد جمع اختصاصه بين الشرطة والصحة والبلدية ، فيدخل فيه إصلاح الشوارع ، والإشراف على نظافتها وإضاءتها وتوسيعها ،

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(١) الفوائد الباهرة فى حكم شوارع القاهرة (خط) .
(٢) الساباط : ممر بين منزلين من أعلى .
(٣) ٤٦ فتوح البلدان طبع أوروبا .

والتشديد على أن يكون البناء على خط التنظيم ، فلا يخرج فى الشارع عن سمت جارة . ويمنع الجلوس على الأفاريز والخروج بالميازيب أعلى الجدران والبروز بسقائف أو مساطب أمام الحوانيت والحكم[1] على الملاك بازالة المبانى المتداعية وهدم ما يتوقع منه ضرر على السابلة [2] ، وقفل الطريق عند إزالة الخلل صوناً للأرواح [3]، وهذا ما حصل عند ما هدمت منارة جامع المؤيد سنة ٨٢١ هـ ١٤١٨ م فان باب زويلة أغلق ثلاثين يوماً .

ومن سلطة المحتسب، أن لا يرخص باقامة مصانع للصناعات الثقيلة أو مدابغ أو مصانع زجاج أو قماين طوب أو جير إلا خارج المدينة .

وقد بلغ من التشديد فى تنفيذ تلك القوانين، النص على إزالة المبانى المعترضة للطريق ، أو التى تقفله وهدمها ، ولو كان المبنى مسجداً [4] .

ومن اختصاص المحتسب منع شغل الطريق بتشوين المون[5] وأدوات البناء ، إلا لفترات قصيرة مدة نقلها ، وله حرية إباحة الخروج بالمشربيات ، وإقامة الأسبطة وميازيب المياه وآبار المجارى طبقاً لسعة الشوارع .

وفى مستهل القرن الرابع عشر الميلادى ، كان من واجبات والى القاهرة ، القيام بتحسين المدينة وتزيينها ، فيأمر بعمارة مافى الدور من خلل ، وتعمير مافيها من خراب ، والاهتمام بتوسعة رحابها ، وتعلية ساباطاتها وسقائف أسواقها ، ولا يمكن أحداً من تضييق الطريق أو إحداث مايضر بالمارة . وأن ينظر فى تنظيف الطرق والرحاب من الأوساخ إن كانت من بيت المال ، وإلا فيأمر السكان بنظافة ماحولهم[6] . وكذلك الخروج بالصناعات المقلقة، وقماين حريق الجير ، والمدابغ ومسابك الزجاج إلى خارج المدينة .

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(١) ابن الأخوة (معالم القربة) ص ٧٨ — ٧٩ .
(٢) خطط الشام جـ ٥ ص ١٣٦ .
(٣) ١٢٥ جـ ٥ على باشا مبارك (الخطط الجديدة) .
(٤) نهاية الأرب جـ ٦ ص ٣١٤ .
(٥) نهاية الأرب جـ ٦ ص ٣١٤ .
(٦) آثار الأول فى ترتيب الدول ص ١٦٥ .

وإذا كان فات جوهر ما أشار به المعز لدين الله واختار موقع القاهرة بنظرته العسكرية ، فان الخلفاء الفاطميين لم تفتهم مواطن الجمال فى أطراف القاهرة والفسطاط والجزيرة ، فانتفعوا بها وبشاطىء النيل ، وحافتى الخليج ، وشبرا ، حيث كانت الخضرة والماء ، فأنشأوا المناظر والحدائق ، وكانوا يقضون فيها أوقاتاً سعيدة . وكان لانتفاعهم بتلك المناطق أثر كبير فى تعميرها بخاصتهم والمقربين منهم ، فامتد العمران إلى خارج أسوار القاهرة .

وفى سنة ٤٨٠هـ - ١٠٨٧م وسع القاهرة الوزير بدر الجمالى من حديها الشمالى والجنوبى ، وأجاز السكنى فيها ، فامتد عمرانها إلى أطرافها وخارج أسوارها ، فصار يقال لأبنية مدينة القاهرة داخل السور. ولما خرج عن أسوارها ظاهر القاهرة ، وأنشئت فيها أخطاط جديدة بعد أن كانت فضاء تشغله البساتين ، هذا عدا حدها الشرقى فيما بين السور والجبل ، فان الحاكم بأمر الله أمر أن تلقى أتربة القاهرة خلف السور لمنع السيول من دخول القاهرة ، فصار منها تلك الكيمان التى تعرف بكيمان البرقية بنهاية شارع الدراسة ، وهى الجارى رفعها الآن بهمة مشكورة .

وفى دولة السلطان صلاح الدين ، ثم فى دولة المماليك ، امتد العمران ، وخاصة فى دولة الناصر محمد بن قلاوون ، حيث زادت القاهرة بمقدار النصف ، وصارت القاهرة والفسطاط مدينة واحدة تمتد من العباسية إلى بركة الحبش (أثر النبى) ومن النيل إلى المقطم (١).

وكان لتحولات النيل فضل كبير فى توسيع رقعة مصر والقاهرة .

ويصفها ابن فضل الله العمرى المؤرخ الجغرافى فى القرن الرابع عشر الميلادى بقوله :

« ولم تزل القاهرة فى كل وقت تتزايد عمارتها ، وتتجدد معالمها ، خصوصاً بعد خراب الفسطاط(٢) سنة ٥٦٤ هـ - ١١٦٨م وانتقال أهلها إليها حتى صارت

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(١) المقريزى المواعظ الاعتبار ج ١ ص ٣٦٥ .
(٢) صبح الأعشى ج ٣ ص ٣٧٠ .

على ماهى عليه فى زماننا من القصور العليّة ، والدور الضخمة ، والمنازل الرحيبة ، والأسواق الممتدة ، والمناظر النزهة ، والجوامع البهجة ، والمدارس الرائعة ، والخوانق الفاخرة ، مما لم يسمع بمثله فى قطر من الأقطار ، ولا عهد نظيره فى مصر من الأمصار » .

هذه لمحة عن نشأة القاهرة ، وتطورها الذى ساير الزمن فامتدت شمالا وجنوباً وغرباً ، وهاهى ستمتد شرقاً بفضل إزالة كيمانها ، تلك النقطة السوداء وسط صحيفتها البيضاء . وإنشاء مدينة المقطم ، ومدينة النصر بالعباسية الشرقية .

هذه المدينة الزاهرة كانت موضع رعاية الحكومات المتعاقبة عليها ، والإشراف على جميع مرافقها حتى نمت وتدرجت مع الزمن ، كما توضحها المصورات الجغرافية .

تنظيم القاهرة

لم يكن تخطيط المدن جزافاً ولا ارتجالا ، فقد وضعت القوانين للتخطيط منذ الفتح الإسلامى ، وعنيت الشريعة الإسلامية بتنظيم تخطيط المدن ، ففى سنن أبى داود : أن النبى صلى الله عليه وسلم أمر بأن ينادى فى معسكره ، بأن من ضيق منزلا أو قطع طريقاً فلا جهاد له ، وذلك حينما لاحظ تضييق صفوف الأخبية فى ميادين القتال (١).

وقال شارح السنن : إنه لا يجوز تضييق الطريق التى يمر فيها الناس ونفى جهاد من فعل ذلك على طريقة المبالغة فى الزجر والتنفير .

وقد وضع عمر بن الخطاب دستوراً لإنشاء المدن ، أذاعه على فاتحى الأمصار ومنشئيها فى صدر الإسلام ، فجعل محور المدينة المسجد بحيث تتفرع الشوارع حوله ، وأن تكون المناهج أربعين ذراعاً . وما يليها ثلاثين ، وما بين ذلك عشرين ، والأزقة سبعة أذرع والقطائع ستين (٢).

(١ ، ٢) التراتيب الادارية ص ٢٨٢ ج ١ .

شرع جوهر فى بناء سور حول المدينة ، وأذن للقبائل بأن تختط كل قبيلة خطة عرفت بها ، ثم أنشأ جامع القاهرة (الأزهر) ، والقصر الشرقى الكبير ، واحتفر الخندق فى الجهة الشمالية ، وقد لوحظ أن الحارات التى اختطتها القبائل كانت قريبة من الأسوار والحارات كحارات : الروم ، وزويلة ، والبرقية .

ومن دراسة القاهرة على ضوء ما كتب عنها ، تبين أنها خططت وقسمت إلى ميادين ورحاب أمام القصور وفيما بينهما ، وأمام مبانيها الرئيسية ومساجدها .

وكان أمام القصر الكبير وفيما بين القصرين الكبير والصغير فى الدولة الفاطمية ، ميدان فسيح كانت تقام فيه حفلات استعراض الجيش ، حيث كان يقف فيه عشرة آلاف ما بين فارس وراجل . وعلى الجانب الغربى لهذا الميدان ، أقيم القصر الصغير الغربى . وعلى جزء من أرضه الآن منشآت المنصور قلاوون . فعرف هذا الميدان ثم الشارع فيما بعد (بين القصرين) . وكان يوجد بجوار القصر الغربى ميدان آخر ، موضعه المنطقة المعروفة بالخرنفش ، وبجواره البستان الكافورى المطل على الخليج .

وباستقصاء مواقع ملحقات القصرين الفاطميين ، عرفنا أنه كان يتوصل إليها من شوارع متسعة ، وحولها الميادين والرحاب ، وهذا ما نراه بصورة مقربة على الخريطة التى وضعها مسيو رافيس استناداً إلى المراجع التاريخية ، وأخالفه فى وضعه باب الفرج على الخليج ، فقد كان فى شارع تحت الربع .

وقد وصف القاهرة الطبيب أبو الحسن على بن رضوان « بأن ارتفاع الأبنية[١] فيها دون أبنية الفسطاط ، وأن أزقتها وشوارعها أنظف منها ، وإذا تأملنا حال القاهرة كانت بالإضافة إلى الفسطاط أعدل وأجود هواء وأصلح حالا » .

وقال ناصر خسرو الرحالة الفارسى وقد زارها سنة ٤٤١ هـ — ١٠٤٩ م يصف تخطيطها : « ويقع قصر السلطان فى وسط القاهرة ، وهو طلق من جميع الجهات ، ولا يتصل به أى بناء ، وكل ما حوله فضاء .... ويبدو هذا القصر

(١) ٣٦٥ — ٦٦ ج ١ مقريزى (المواعظ والاعتبار) .

من خارج المدينة كأنه جبل لكثرة ما فيه من الأبنية المرتفعة .... » [١].

واستطرد فى الوصف إلى أن قال : « وليس للمدينة قلعة ، ولكن أبنيتها أقوى وأكثر ارتفاعاً من القلعة . وكل قصر حصين . ومعظم العمارات يتألف من خمس أو ست طبقات » .

غير أن المعز لدين الله حينما قدم إلى القاهرة سنة ٣٦٢ هـ — ٩٧٣ م لم يرق فى نظره موقعها لأنها بغير ساحل ، ووجه اللوم إلى جوهر وقال له : « فاتك بناء القاهرة على النيل عند المقس (ميدان المحطة) ، فهلا كنت بنيتها على الجرف؟ (منطقة الرصد)[٢] » وله كل الحق فى نقده ، فان منطقة الرصد التى أشار اليها منطقة جميلة تشرف على النيل والجبل وبركة الحبش ، وجمعت بين السهل والجبل ، وبين الخضرة والماء ، وقد وصفها الشاعر الأشبيلى أبو الصلت أمية ابن عبد العزيز بقوله :

يا نزهة الرصد المصرى قد جمعت ... من كل شىء حلا فى جانب الوادى
فذا غدير وذا روض وذا جبل ... والضب والنون والملاح والحادى

وخير وصف لها ، ذلك الذى وصفها به أمير مصر موسى بن عيسى ، إذ خرج يوماً إليها فقال لمن حوله :

« أتتأملون الذى[٣] أرى ؟ قالوا وما الذى يرى الأمير ؟ قال : أرى ميدان رهان ، وجنان نخل ، وبستان شجر ، ومنازل سكنى ، وذروة جبل ، وجبانة أموات ، ونهراً عجاجاً ، وأرض زرع ، ومراعى ماشية ، ومرتع خيل ، وساحل بحر ، وصائد نهر ، وقانص وحش ، وملاح سفينة ، وحادى إبل ، ومفازة رمل ، وسهلا وجبلا ، فهذه ثمانية عشر متنزهاً فى أقل من ميل فى ميل » .

(١) سفرنامه ص ٤٨ تعريب الدكتور الخشاب .
(٢) ص ١٢٨ ج ١ المواعظ والاعتبار للمقريزى ، ٣٧١ ج ٣ صبح الأعشى ، اتعاظ الحنفا ص ٧٤ ، وهذا المرتفع الصخرى على يسار الذاهب إلى المعادى ، تجاه منطقة أثر النبى .
(٣) المواعظ والاعتبار ج ٢ ص ١٥٣ .

تخطيط القاهرة وتنظيمها منذ نشأتها *

بقلم

حسن عبد الوهاب

كبير مفتشى الآثار الاسلامية .

عنيت الشعوب الإسلامية بتخطيط المدن التى أنشأتها عقب الفتوحات الإسلامية، وراعوا فى تخطيطها القواعد الصحية من شق شوارع، وعمل ميادين ورحاب ، وتقسيمها إلى شوارع وسكك وحارات وأزقة .

وقد تضمنت قوانين تخطيط المدن الخروج بالمدافن والمصانع المقلقة إلى أطراف المدينة ، كالحدادة ، ومصانع الزجاج ، وقماين الجير والطوب ، والبعد بالأسواق عن مقر الحكم .

وكذلك خصصت لكل صناعة سوقاً خاصة بها ، كما خصت التجارات بأسواق لاحقت بعضها عرفت بها الأخطاط الواقعة فيها .

وعندما كانت تنشأ مدن جديدة ، امتداداً لمدن أخرى سبقتها ، كانت تخصص المدينة الجديدة أولا لسكنى الوالى، أو الخليفة وحاشيته، والمقربين منه، وهذا ما فعله القائد جوهر حينما أنشأ مدينة القاهرة سنة ٣٥٨ هـ — ٩٦٩م امتداداً للفسطاط والعسكر والقطائع . فانه أعدها لتكون دار خلافة ينزلها الخليفة وعساكره وخواصه ، وهكذا كانت الحالة فى أطراف المدينة حينما كان يسكنها الخلفاء أو الملوك ، فانها تكون سبباً فى عمران ماخولها .

(*) محاضرة ألقيت بالمجمع العلمى المصرى فى جلسة ٤ إبريل سنة ١٩٥٥ .

EXTRAITS
DES PROCÈS-VERBAUX DES SÉANCES

SEANCE PUBLIQUE DU 15 NOVEMBRE 1954

La séance est ouverte à l'Institut d'Egypte à 6 heures p.m.

SONT PRESENTS :

le Prof. Mohamed Kamel Hussein	*Président*
Ch. Kuentz	*Secrétaire général*
le Dr. I.G. Lévi	*Trésorier-bibliothécaire*
le Prof. L. Keimer	*Secrétaire-adjoint*

MEMBRES TITULAIRES :

R.P.G. Anawati, MM. Ch. Avierinos, P. Balog, L. Christophe, K.O. Ghaleb, J.-E. Goby, E. Greiss, H. Hickmann, Ismail Ratib, M. Jungfleisch, J.-Ph. Lauer, M.R. Madwar, Mohamed Kamel Moursy, Mohamed Mostafa, Osman Rifki Rostom, Sami Gabra.

MEMBRES CORRESPONDANTS :

MM. Abdel Mohsen El-Khachab, Alexandre Badawy.

ASSISTENT A LA SEANCE :

Mme H. Hickmann, Mme M. Jungfleisch, Mlle Dya Abou Ghazi, MM. M. v. Bothmer, F. Debono, Krotkoff, H. Lowy, Marzini et Mme, Shawky Moustapha, Sauneron, Vénizelo et Mme, V. Vikentiev, Yoyotte.

1. — Le Président souhaite la bienvenue à M. le Dr. Mohamed Mostafa, nouveau membre titulaire, présent en séance.

2. — Le Président félicite :

a) M : J.-Ph. Lauer pour le titre de Chevalier de la Légion d'Honneur.

b) M. le Dr. Bishr Farès pour :

1° - Prix Marmottan 1954 de l'Académie des Beaux-Arts, Institut de France, Paris pour son étude *Le Livre de la Thériaque*, publiée par l'Institut Français d'Archéologie Orientale en 1953.

2° - Prix Fondation Wacif Boutros Ghali de l'Association France-Egypte pour ses deux ouvrages "*Le Livre de la Thériaque*" et le *Lexique français-arabe des termes techniques relatifs aux arts figurés* publiés par l'Institut d'Egypte en 1948.

3. — Le Secrétaire Général annonce le décès du Dr. S. Mihaeloff membre correspondant du 6 février 1939 au 22 avril 1947 et membre titulaire à partir du 23 avril 1947.

4. — Le Secrétaire Général présente des ouvrages, brochures et tirés à part offerts à l'Institut par MM. P.V. Aubry, A. Dontas, H. Field, R. Gandilhon H. Hickmann, J. Janssen, M. Jungfleisch, P. Kool, Ch. Kuentz, Légation d'Autriche, M. Monnerot-Dumaine, G.W. Murray, W.D. van Wijngaarden.

M. J.-E. Goby prend la parole pour attirer l'attention des presents sur l'ouvrage de M. René Taton intitulé l'*Oeuvre Scientifique de Monge* qu'il recommande à l'Institut.

Le Président remercie les donateurs.

5. — M. M. Jungfleisch lit sa communication "La Conquête du Midi sur des monnaies turco-égyptiennes".

6. — M. le Dr. H. Hickmann lit sa communication "La danse aux miroirs".

7. — M. le Dr. Y. Shawky Moustapha lit sa communication "Preliminary Notice on the Domesticated Fauna of the New Saqqara Pyramid".

Le Prof. L. Keimer prend la parole pour présenter quelques observations.

Le Président lève la séance à 7 heures 15 p.m.

L'Institut se forme ensuite en Comité Privé.

Le Sécrétaire Général
CH. KUENTZ

INSTITUT D'EGYPTE

Séance du lundi 15 *Novembre* 1954

Résumés des communications lues en séance.

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1. — M.M. JUNGFLEISCH. — *La Conquête du Midi sur des monnaies turco-égyptiennes.*

De petites monnaies d'une épaisseur insolite furent frappées au Caire en 926 H. pour célèbrer la quinquenalia de la "Conquête du Midi" par Selim 1 et peut être aussi pour préparer les esprits à la "Conquête du Nord" qu'il fut donné à Soliman I d'entreprendre.

2. — M. le Dr. H. Hickmann. — *La danse aux miroirs.*

La danse aux miroirs représentée dans le mastaba de Merérouka :Saqqârah', est une sorte de ballet exécuté par un groupe de jeunes entrechoquant quelques instruments de percussion et se reflétant dans des miroirs. Il a été possible de retracer la signification de cette danse de l'Ancien Empire et d'en reconstituer les différentes phases chorégraphiques Ces dernières, dorénavant connues, permettent par conséquent l'étude musicale du rythme de cette ancienne danse.

Une second ballet, représenté aussi dans le mastaba de Merérouka, a été soumis à l'analyse musicologique. La reconstitution complète de cette "danse des garçonnets" jette également quelques nouvelles lumières sur le mouvement, la mesure et le rythme de la musique de danse des anciens Egyptiens, sous l'Ancien Empire.

3. — M. le Dr. Y. Shawki Moustapha. — *Observation préliminaire sur la faune domestiquée de la nouvelle Pyramide de Sakkarah.*

Dans une fosse au-dessus de la nouvelle Pyramide de Sakkarah ont été découverts des restes d'animaux domestiqués (brebis, chèvre, chien, âne, porc et boeuf). Celà prouve la XXVIe dynastie. Les égyptiens dressaient ces animaux pour les sacrifier ou pour les utiliser en médecine ou pour des pratiques magiques.

SEANCE PUBLIQUE DU 6 DECEMBRE 1954

La séance est ouverte à l'Institut d'Egypte à 6 heures p.m.

SONT PRESENTS :

Bureau :

MM. le Prof. Mohamed Kamel Hussein *Président*

Ch. Kuentz .... *Secrétaire Général*

le Dr. I.G. Lévi .... *Trésorier-bibliothécaire*

le Prof. L.Keimer .... *Sécrétaire adjoint*

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Excusés : MM. P. Balog, P. Ghalioungui, H. Hickmann, M. Jungfleisch, Sami Gabra.

MEMBRES CORRESPONDANTS :

MM. Abdel Mohsen El-Khachab, Alexandre Badawy, G. Michailidis, Ibrahim El-Mouelhy.

Excusé : M. Hassan Abdel Wahab.

ASSSISTENT A LA SEANCE :

Mme Aramian, Mme V. Tâckholm, Mlle Dya Abou Ghazie MM. Hassan Awad, G. Krotkoff, Mûller, Pahor Labib, Maurice. Raphaêl, Soliman Azmi, Venizelo et Madame, V. Vikentiev et Madame,

1. — Le Secrétaire Général donne lecture du procès-verbal du 15 novembre 1954, qui est approuvé.

2. — Le Président annonce le décès de :

a) Ugo Monneret de Villard, membre associé depuis le 9 février 1949.

b) E. Stromer von Reichenbach, membre correspondant depuis le 21 février 1938.

on observe une minute de silence en signe de deuil.

3. — M. M. I. ATTIA lit la communication de M. L.R. Cox "Lamellibranchia from the Nubian Sandstone Series of Egypt".

4. — M.V. VIKENTIEV lit sa communication "Le *Silphium* et le rite du renouvellement de la vigueur".

Le Président lève la séance à 7 heures 5 p.m.

L'Institut se forme ensuite en Comité Privé.

Le Secretaire Général
CH. KUENTZ

INSTITUT D'EGYPTE

Séance du lundi 6 Décembre 1954

Résumés des communications lues en séance.

1. — M. L.R. Cox (lecture de M.I. Attia). -- *Lamellibranches des grès de Nubie en Egypte.*

Quelques fossiles lamellibranches recueillis dans le grès de Nubie de la région Est d'Assouan, ont été soumis au Dr. L.R. Cox. Il a identifié trois fossiles marins, dont deux d'espèces nouvelles.

INOCERAMUS — Sp.

ISOCARDIA AEGYPTIACA — Sp. nov.

CYPRINA HUMEI — Sp. nov.

et cinq fossiles d'eau dont trois : (probablement quatre) sont d'espèces nouvelles.

UNIO JOWIKOLENSIS — NEWTON

UNIO ATTIAI — Sp. Nov.

UNIO NUBIANUS — Sp. nov.

IRIDINA (PLEIODON) *aswanensis* — Sp. nov.

IRIDINA (Pleiodon) Sp.

Il a aussi remarqué que *Iridina* et son sous-genre *Pleiodon* caractéristiquement africain aujourd'hui, existait en Egypte à l'époque Crétacée.

2. — M.V. VIKENTIEV. — *Le Silphium et le rite du renouvellement de la vigueur.*

Dans tout le Proche Orient, depuis l'époque sumérienne et les débuts égypto-libyens de la civilisation nilotique, est en vogue la gommerésine d'une plante ombellifère, connue sous différents noms, tels que ''parfum libyen'', *laserpitium* et *silphium*. Son nom akkadien *hiltit* est parvenu jusqu'à nous a peine changé en *haltyt*. Aussi durable est l'emploi de cette drogue. On s'en servait anciennement, et on continue de le faire jusqu'à présent, comme d'un fortifiant, stimulant et aphrodisiaque.

Les anciens, qui la connaissaient depuis le temps du légendaire Ménès, l'employaient comme médicament dans les mêmes cas que maintenant.

L'emploi le plus spéctaculaire en était fait pendant les fêtes jubilaires, dites HEB SED, tendant à redonner au pharaon âgé son ancienne vigueur. C'est pendant sa course rituelle que la drogue lui était administrée. On s'en servait aussi, comme d'un condiment, pendant le repas solennel cloturant les festivités.

SEANCE PUBLIQUE DU 10 JANVIER 1955

La séance est ouverte à l'Institut d'Egypte à 6 heures p.m.

SONT PRESENTS :

Bureau :

MM. le Prof. Dr. Mohamed Kamel Hussein *Président*

Ch. Kuentz .... *Secrétaire Général*

le Prof. L. Keimer .... *Secrétaire-adjoint*

Excusé : M. le Dr. I.G. Lévi, trésorier-bibliothécaire.

MEMBRES TITULAIRES :

R.P. G. Anawati, MM. A. Alfiéri, Ch. Avierinos, P. Balog. Bishr Farès, L. Christophe, K.O. Ghaleb, J.-E. Goby, E. Greiss, O, Guéraud, Hamed Zaki, H. Hickmann, M. Jungfleisch, J. Ph. Lauer, MR. Madwar, Mourad Kamel, Ismail Ratib, Osman Rifki Rostem.

Excusés : MM. R. Cattaui, Mohamed Mostafa, Sami Gabra, Taha Hussein. M.A. Grohmann, membre associé.

MEMBRES CORRESPONDANTS :

MM. Abdel Mohsen El-Khachab, Alexandre Badawy, Ibrahim El-Mouelhy, Hassan Abdel Wahab, G. Michailidis.

ASSISTENT A LA SEANCE :

Mme Bianchi (Lugano), Mme Bianchi (Le Caire) Mme Mamlouk Mme Y. Senn-Ayrout, Mme Tagher, R.P. H. Ayrout, MM. Ahmed Rachad, Aly Shafei, Brugman, G. Debien, E. Gamper, J. Sainte Fare Garnot, Honigsberg Renardel de Lavalette, Ch. Ratton, Sir Walter Smart, D. Venizelo et Mme, Wild.

1. — Le Secrétaire Général donne lecture du procès-verbal du 6 décembre 1954, qui est approuvé.

2. — Le Président félicite :

a) M. le Dr. TAHA HUSSEIN, pour sa nomination comme chef de la section culturelle de la Ligue Arabe.

b) M. le Prof. L. Keimer, pour le titre d'Officier de l'Ordre d'Orange Nassau.

c) M. le Dr. H. HICKMANN, pour sa nomination comme 1°) membre correspondant du Comité ethno-musicologique du " Royal Anthropological Institute" de Londres 2°) membre correspondant de l'Institut Archéologique Allemand (Berlin).

3. — Le Secrétaire Général présente des ouvrages, brochures et tirés à part offerts à l'Institut par MM. Alexandre Badawy, Compagnie du Canal de Suez L. Christophe, M. Dalloni, F. Heiler, M. Jungfleisch, M.R. Madwar, G. Miles, Mohamed Mostafa, M.R. Sponenburgh.

Le Président remercie les donateurs.

4. — M. le Prof. L. Keimer lit sa communication "La jeune esclave et le guépard. A propos d'une statuette en faience émaillée de Basse-Epoque".

5. — M. le Dr. Amin Riad Guindy lit sa communication "The Igneous and Methamorphic Rocks of the Assouan Area, Egypt.

Le Président lève la séance à 7 heures 20 p.m.

L'Institut se forme ensuite en Comité Privé.

Le Secrétaire Général
CH. KUENTZ

INSTITUT D'EGYPTE

Séance du lundi 10 *Janvier* 1955

Résumés des communications lues en séance.

1. — M. le Prof. L. KEIMER. — *La jeune esclave et le guépard. A propos d'une statuette en faience émaillée de Basse-Epoque.*

Feu Achille Groppi possédait une superbe statuette de faience émaillée datant de la Basse-Epoque (peut-être de l'Epoque Bubastide) et représentant une esclave (de type asiatique), portant sur le dos un guépard (panthère ou léopard de chasse) qui est sans conteste le plus doux et le plus sûr de tous les félins. On a apprivoisé depuis longtemps et la vraie panthère (ou léopard) et le guépard, mais seul ce dernier a joué un rôle comme auxiliaire de chasse. Pour les anciens Egyptiens le guépard était un animal du "Nord", le vrai léopard un fauve du "Sud". Le guépard vivait jusqu'à tout récemment en nombre restreint à l'ouest d'Alexandrie, c'est-à-dire tout à fait au Nord du pays. La vraie panthère a dû quitter l'Egypte depuis bien longtemps, mais elle subsiste encore au Sinaî qui, bien que faisant partie du territoire égyptien, était pour les anciens Egyptiens toujours un pays étranger. Au point de vue artistique, la statuette Achille Groppi est un véritable bijou.

2. — M. le Dr. AMIN RIAD GINDY.

Les roches ignées et métamorphiques de la région d'Assouan.

Les roches les plus anciennes de la région d'Assouan se sont des schistes micacés, d'origine sédimentaire, pénétrés par des masses basiques. Au cours d'une orogénie subséquente, des fluides acides (pegmatites) ont transformé, par endroits, les roches préexistantes en granite à gros grain (porphyroîde). Ce dernier est ainsi d'origine métamorphique et c'est un produit en place malgré son mouvement postérieur dans les lieux où ces transformations deviennent de plus en plus intenses. Enfin, les intrusions d'un granite à petit grain, des séries des masses basiques, dioritiques, lamprophyres etc., toutes d'origine magmatique, terminent l'histoire plutonique de la région.

SEANCE PUBLIQUE DU 7 FEVRIER 1955

La séance est ouverte à l'Institut d'Egypte à 6 heures p.m.

SONT PRESENTS :

Bureau :
M. le Dr. S.A. HUZAYYIN.................... *Président*
M. le Prof. L. KEIMER, &
M. le Prof. Sami Gabra .... *Vice-Présidents*
M. Ch. Kuentz .... *Sécrétaire Général*

Excusé :
M. le Dr. I.G. Lévi............................ *Trésorier-bibliothécaire*

MEMBRES TITULAIRES :
R.P. G. Anawati, MM. A. Alfiéri, M.I. Attia, Ch. Avierinos, P. Balog, Bishr Farès, R. Cattaui, L. Christophe, K.O. Ghaleb, P. Ghalioungui, J.-E. Goby, R. Godel, E. Greiss, O. Guéraud, Hamed war, Mohamed Kamel Hussein, Mohamed Mostafa, Moustapha Amer, Ismail Ratib, Osman Rifki Rostom Mohamed Sobhy, Taha Hussein.

MEMBRES ASSOCIES :
MM. A. Grohmann et L. Massignon.

MEMBRES CORRESPONDANTS :
MM. Abdel Mohsen El-Khachab, Abdel Rahman Zaki, Alexandre Badawy, Hassan Abdel Wahab, Ibrahim El-Mouelhy, G. Michailidis.

ASSISTENT A LA SEANCE :
Mme J. Sainte Fare Garnot, Mme J-E. Goby, Mme 0. Guéraud, Mme Sami Gabra, MM. Abdel Aziz Osman, Daninos, J. Barthe-Déjean, G. Debien, J. Sainte Fare Garnot, B. Ghali et Mlle, G. Krotkoff, Lagana, H. Lôwy, Marzini, Naguib Boulos, Pahor Labib, Aly Shafei, Venizelo et Mme, Zaki Nour.

1. — Le Secrétaire Général donne lecture du procès-verbal du 10 javier 1955, qui est approuvé.

2. — M. le Dr. S.A. Huzayying prend la parole pour remercier les membres de l'Institut de l'avoir élu président lors des dernières élections du Bureau pour l'année 1955-56.

3. — Le Secrétaire Général fait part aux membres de l'Institut du désir du Bureau d'accueillir des communications sur des sujets d'actualité, sans négliger pour autant les sujets d'études habituels, et de voir participer aux travaux de l'Institut les universitaires des différentes Facultés.

4. — Le Président félicite M. le Dr. Bishr Farès pour son élection comme membre d'honneur de la Société turque d'Histoire de la Médecine, en considération de son étude "*Le Livre de la Thériaque*".

5. — Le Président annonce le décès du Prof. G.V. Anrep, membre titulaire depuis le 1 février 1937.
On observe une minute de silence en signe de deuil.

6. — Le Secrétaire Général présente le nouveau Bulletin tome XXXVI, fasc. 1, ainsi que des brochures et tirés-à part offerts à l'Institut par MM. A. Alfiéri, Bishr Farès, Hassan Ch. Efflatoun, A, Ghigi, Ibrahim El-Mouelhy, M. Junglfeisch et Monnerot-Dumaine.
Le Président remercie les donateurs.

7. — M. J.-E. Goby lit sa communication "Projets de barrages-réservoirs en Egypte au XIXe siècle".

8. — M. Jean Sainte Fare Garnot lit sa communication "Remarques sur quelques noms royaux des trois premières dynasties égyptiennes".

9. — M. le Dr. Abdel Aziz Osman lit sa communication "The Statigraphy of the Pre-Tertiary Sub-Surface Formations of Abu-Roash".

Le Président lève la séance à 7heures 40 p.m.

L'Institut se forme ensuite en Comité Privé.

Le Secrétaire Général
CH. KUENTZ

INSTITUT D'EGYPTE

Séance du lundi 7 Février 1955

Résumés des communications lues en séance.

1. — M. Jean-Edouard Goby — *Projets de barrages-réservoirs en Egypte au XIXe siècle.*

La construction du barrage d'Assouan de 1898 à 1902 a été le couronnement d'efforts persévérants et d'études approfondies dont M. Jean-Edouard Goby dans sa communication sur les *Projets de barrages-réservoirs en Egypte au XIXe siècle* s'est proposé de présenter une synthèse. Des esprits clairvoyants comme A. de la MOTTE, Cope WHITEHOUSE et Alexandre PROMPT ont été entre 1880 et 1890 les protagonistes infatigables de l'établissement en Egypte d'un vaste réservoir régularisant dans le temps le cours du fleuve et en démontrèrent par avance la rentabilité. A différentes époques, Linant de BELLEFONDS, La MOTTE et L. JACQUET proposèrent de barrer le Nil à Silsileh; WHITEHOUSE fut le champion de l'aménagement en réservoir de la cuvette de l'Ouadi Rayan; PROMPT et Alexandre BOULE préconisèrent l'édification d'un ouvrage à Kalabcheh. Après de longues années d'études, William WILLCOCKS, probablement le plus grand ingénieur hydraulicien qui servit l'Egypte dans les temps modernes, proposa le site d'Assouan qui fut adopté en définitive. Ce choix était extrêmement judicieux et depuis plus d'un demi-siècle, le barrage a rendu à l'économie égyptienne des services inappréciables.

2. — M. Jean SAINTE FARE GARNOT. — *Remarques sur quelques noms royaux des trois premières dynasties égyptiennes.*

La plupart des noms royaux des trois premières dynasties ont une signification. Les uns définissent une qualité du roi, les autres énoncent une profession de foi religieuse.

Dans la première série rentrent notamment les noms d'Horus de Djoser (IIIe dynastie) et du pharaon pour lequel fut bâtie la pyramide à degrés récemment découverte par le Docteur Zacharie Ghoneim. Ces noms sont des superlatifs, signifient : le plus divin (ou: le plus puissant) de la corporation des dieux. La seconde série comprend en particulier les "noms de conciliation" (ou d'apaisement") proclamant

la dévotion de certains pharaons aux dieux rivaux: Horus et Seth. A la liste ancienne il faut ajouter le nom du "Seth" Peribsen (IIe dynastie). Ce souverain doit être identifié, comme on l'a proposé autrefois, à l'"Horus" sekhem-ib.

3. — M. le Dr. ABDEL AZIZ OSMAN. — *La stratigraphie des formations prétertiaires du sous-sol d'Abou-Rouach.*

La région d'Abou-Rouach se trouve à 8 km NNO des Pyramides de Guizeh et à 15 km à l'ouest du Caire.

L'étude des foraminifères rencontrés dans les carottes du sondage no. 1 et dans les tranchées exécutées par la "Standard Oil Co. of Egypt" a permis à l'auteur d'attribuer aux formations prétertiaires du sous-sol d'Abou-Rouach les âges suivants : cénomanien, crétacé inférieur et jurassique. Elle lui a permis en outre de distinguer un certain nombre de zones microfaunales qui pourraient être utiles pour les corrélations locales. Finalement l'auteur a démontré la correlation des formations jurassiques de cette région avec celles du Gebel Moghara au Sinaï nord-oriental.

INSTITUT D'EGYPTE

Séance du lundi 14 *Mars* 1955

Résumés des communications lues en séance

1. — M. L. A. CHRISTOPHE. — *Histoire d'un nouvel hôte du Caire, le colosse Memphite de Ramsès II. Avec projections par M. J.-Ph. Lauer.*

Le commandant d'aviation Abd el Latif Boghdadi vient de faire transporter au Caire l'un des colosses de Ramsès II qui se trouvait dans la palmeraie de Memphis. Ce colosse, en granit a été découvert par Horner pendant l'hiver 1853-1854. Le major Arthur Bagnold l'a entièrement dégagé en 1887 et transporté sur une butte artificielle pour le soustraire à l'action des eaux d'infiltration.

Ce colosse fut taillé dans les carrières d'Assouan pour Ramsès II (XIXe dynastie). Le célèbre souverain fit représenter sur sa statue sa fille et épouse Bent-Anta et un petit prince anonyme. A la XXe dynastie, Ramsès IV usurpa le monument : il remplaça partout les noms de Ramsès II par les siens : sur les bracelets, sur le pectoral, sur les épaules et sur la boucle de la ceinture. Quelques années plus tard, Ramsès VI s'apprporia l'inscription dorsale.

Ainsi le monument qui s'élèvera bientôt Place de la Gare au Caire ne porte plus les noms de Ramsès II; mais la petite reine est toujours là pour nous faire connaitre l'époque où la statue colossale a été taillée, sculptée, gravée et dressée devant le grand temple de Ptah à Memphis.

M. Jean-Philippe Lauer a projeté à la suite de la communication de M. L. A. Christophe une série de photographies qu'il a prises des diverses opérations de l'enlèvement de ce colosse, lors de son récent transfert de la palmeraie de Memphis au Caire, exécuté par le Service des Chemins de fer avec le concours de l'Armée et sous le contrôle de la Section d'Architecture du Service des Antiquités. Le déplacement de ce colosse pesant a lui seul plus d'une cinquantaine de tonnes nécessita toute une succession d'opérations que M.Lauer a commentées

sur les projections mêmes, à savoir: l'établissement d'un pont métallique sur lequel devait reposer, la statue durant son transport, la prise en charge du colosse par ce pont que l'on substitua aux piles qui le portaient jusqu'alors, l'aménagement d'une tranchée avec rampe d'accès pour l'introduction sous le colosse de la puissante remorque sur laquelle il allait être tiré, l'arrimage du pont support et du colosse sur la remorque, enfin la traction de l'ensemble depuis Mît-Rahineh jusqu'au Caire par la route, après qu'eurent été lancés deux ponts militaires métalliques par-dessus les ponts existants sur les canaux à franchir au sortir de la palmeraie de Memphis.

2. — M. Mark Ritter SPONENBURGH. — *Influence égyptienne dans la sculpture aux Etats-Unis.*

L'auteur expose les influences de la statuaire égyptienne sur la production des sculpteurs aux Etats-Unis et prouve qu'après un siècle d'inspiration les œuvres récentes témoignent d'une compréhension de l'esprit même de la sculpture égyptienne.

3. — M. le Dr. MOSTAFA ABDEL AZIZ & M.S. NAIM. — *La preuve physiologique de la résistance de certaines variétés de cotons égyptiens et leurs sujetions au désséchement par l'atteinte de la maladie du fusarium* (2) *L'Influence des produits métaboliques sur la croissance du coton et la façon de l'atteinte.*

L'objet de l'étude est l'effet des produits métaboliques du fusarium provoquant la maladie du désséchement du coton; le degré ou la force de croissance dans les différentes espèces, de même que la façon par laquelle le champignon pénétre dans les pousses du genre "Guiza 26" sujet à l'atteinte par le désséchement, et le genre "Karnak" offrant une résistance relative.

SEANCE PUBLIQUE DU 14 MARS 1955

La séance est ouverte à l'Institut d'Egypte à 6 heures p.m.

SONT PRESENTS :

BUREAU : MM. le Prof. L. Keimer... *vice-président*
Ch. Kuentz ....*secrétaire général*
le Dr. I.G. Lévi *trésorier-bibliothécaire*

EXCUSÉS: M. le Dr. S.A. Huzayyin, président et M. le Prof. Sami Gabra, vice-président.

MEMBRES TITULAIRES : R.P. G.C. Anawati, MM. A. Alfiéri, Helmy Bahgat Badawy, P. Balog, Bishr Farès, R. Cattaui, L. Christophe, Hassan Ch. Efflatoun, K.O. Ghaleb, J.-E. Goby, R. Godel, E. Greiss, H. Hickmann, M. Jungfleisch J.-Ph. Lauer, M.R. Madwar, Mansour Fahmy, Mohamed Kamel Hussein, Mohamed Mostafa, H. Mosséri, Ismail Ratib.
EXCUSÉS : M. le Dr. Moustapha Amer, M. le Dr. Mourad Kamel et M. le Dr. Taha Hussein.

MEMBRES CORRESPONDANTS : MM. Abdel Mohsen El-Khachab, Alexandre Badawy, G. Michailidis.

ASSISTENT A LA SEANCE : Mme Christophe, Mme et Mlle Decamp, Mme Galassi, Mme Vivi Tâckholm, Mme J. Tagher, Mlle Dya Abou Ghazi, Mlle Ghali, Mlle G. Michailidis, MM. Arnaldez, Bothmer, F. Débono, Jean Sainte Fare Garnot, Maamoun Ghoneim, J. Haggar, Ant. Khater, Lagana, Lajuncomme, H. Löwy, R. Machard, Marzini, Moscatelli, R. Mosséri, Moustapha Abdel Aziz, M.S. Naim Souvestre, V. Vikentiev, Vincenot et Mme.

1. — Le Secrétaire Général donne lecture du procès-verbal du 7 février 1955, qui est approuvé.

2. — Le Vice-Président souhaite la bienvenue à M. le Dr. Helmy Baghat Badawy, nouveau membre titulaire.

3. — Le Vice-Président félicite :

a) M. le Prof. MOHAMED KAMEL HUSSEIN pour sa nomination comme membre du conseil de l'institution de la Cité Universitaire du Caire.

b) M. ABDEL HAMID BADAWY pour son élection aux fonctions de vice-président de la Cour Internationale de la Haye.

c) M. le Dr. BISHR FARES

(1°) pour sa nomination comme membre sociétaire de l'Association internationale des critiques d'Arts.
2°) pour son élection comme président de la Section Egyptienne rattachée à l'Association internationale des critiques d'arts lors du Congrès international de cette association, qui s'est tenu à Istanboul.

d) M. OSMAN RIFKY ROSTEM pour sa nomination comme membre sociétaire de l'Association internationale des critiques d'Arts.

4. — Le Secrétaire Général présente des tirés à part offerts à l'Institut par MM. J.-Cuvillier, L.-A. Fontaine, J. Janssen, M. Jungfleisch.

Le vice-président remercie les donateurs.

5. — M. L.-A. Christophe lit sa communication "Histoire d'un nouvel hôte du Caire, le colosse Memphite de Ramsès II." à la suite de laquelle M. J.-Ph. Lauer commente sur projections le transport de ce colosse.

6. — M. le Dr. Alexandre Badawy lit la communication de M. Mark Ritter Sponenburgh "Egyptian Influence in the Sculpture of the United States."

7. — M. le Dr. M.S. Naim lit sa communication "Physiological Significance of Resistance and Susceptibility to Fusarium Wilt of Some Egyptian Cotton Varieties : II. - Effect of Fungal Metabolites on Cotton Vigour and Mode of Penetration."

Le Vice-Président lève la séance à 7 heures 20 p.m.

L'Institut se forme ensuite en Comité Privé.

Le Secretaire Général
Ch. KUENTZ

SEANCE PUBLIQUE DU 4 AVRIL 1955

La séance est ouverte à l'Institut d'Egypte à 6 heures p.m.

SONT PRESENTS :

BUREAU : MM. le Prof. L. Keimer et le Prof. Sami Gabra — *vice-présidents*
Ch. Kuentz .... *secrétaire général*
le Dr. I. G. Lévi, *trésorier-bibliothécaire*
J.-Ph. Lauer, ... *secrétaire adjoint*

EXCUSÉ: M. le Dr. S.A. Huzayyin, *président*

MEMBRES TITULAIRES : MM. Ch. Avierinos, P. Balog, Bishr Farès, R. Cattaui, L. Christophe, Hassan Chaker Efflatoun, K.O. Ghaleb, E. Greiss, M. Jungfleisch, M.R. Madwar, Mohamed Kamel Hussein, Mohamed Kamel Moursy, Mohamed Moustapha, Ismail Ratib.

MEMBRES CORRESPONDANTS : MM. Abdel Fatah Helmy, Abdel Mohsen El-Khachab, Abdel Rahman Zaki, Hassan Abdel Wahab, Ibrahim El-Mouelhy, G. Michailidis.

ASSISTENT A LA SEANCE : Mme V. Tâckholm, MM. H.A. Foda, Jean Sainte Fare Carnot, Hussein Rached, Kamel Yousry, H. Löwy, Mahmoud Riad, Marzini, Cheihk Mohamed Osman, A. Shata, Zakour.

1. — Le Secrétaire Général donne lecture du procès-verbal du 14 mars 1955, qui est approuvé.

2. — Le Secrétaire Général présente des tirés à part offerts à l'Institut par M. L. Christophe et M.J. - Ph. Lauer.
Le Vice-Président remercie les donateurs.

3. — M. Hassan Abdel Wahab lit sa communication "Tracé de la ville du Caire et son organisation depuis sa fondation."

M. le Dr. Bishr Farès prend la parole pour présenter quelques observations.

4. — M. le Vice-Président annonce à l'assemblée que M. le Dr. H. Hickmann étant souffrant s'excuse de ne pouvoir donner lecture de sa communication.

5. — M. le Prof. A. Nasr lit sa communication "Phycosociological Studies of the Marine Algae of Ghardaqa (Red Sea).

6. — M. le Dr. H.A. Foda lit sa communication "Geographical Distribution, Structure and Reproduction of Zygophyllum album L." Mme. Vivi Tâckholm et M. le Prof. L. Keimer prennent la parole pour présenter quelques observations.

7. — M.A. Shata lit sa communication "Oil Possibilities of the west Sinai Foreshore Province (Egypt).

Le Vice-Président lève la séance à 7 heures 20 p.m.

L'Institut se forme ensuite en Comité Privé.

Le Secrétaire Général
CH. KUENTZ.

INSTITUT D'EGYPTE

Séance du lundi 4 *Avil* 1955

Résumés des communications lunes en séance

1. — M. HASSAN ABDEL WAHAB. *Tracé de la ville du Caire et son organisation depuis sa fondation.*

Mr. Hassan Abdel Wahab, premier inspecteur des monuments islamiques, a abordé l'histoire de la ville du Caire, faisant allusion aux méthodes modernes dans le tracé des rues et des places publiques et de vastes avenues dont l'axe était constitué par le Grand Palais. Il a ajouté que dans le tracé en question on a tenu compte des directives de "Omar ibn al-Khattâb", qui a déterminé la largeur des rues principales, des places publiques et des ruelles. D'autre part, le législateur a établi des lois pour construire sur le tracé officiel et ne pas élever de constructions et des plates-forme qui generaient la circulation et a défendu d'entraver le trafic de la rue par une construction, fût-elle une mosquée. Le Directeur du Tanzim à cette époque octroyé le pouvoir de mettre en application ces instructions et de mettre fin aux contraventions. Il avait en quelque sorte l'autorité de la Municipalité aujourd'hui.

Puis, le conférencier a parlé abondamment des méthodes employées dans l'éclairage des rues et des marchés (souks) et de leur entretien, du nivellement des rues, de l'expropriation, de l'extinction des incendies, de l'embellissement de la ville, de la suppression des constructions en ruine en les entourant d'un mur pour les dissimuler aux regards et de la division du Caire en zones d'habitation et en zone industrielle. En outre, l'Egypte a employé les cartes d'identité et a donné un numéro d'ordre aux maisons et a fixé des pancartes donnant le nom des rues depuis un siècle et demi.

Finalement, le conférencier a donné des vues photographiques et panoramiques.

Le sujet est certainement des plus intéressants et n'a jamais été abordé auparavant.

2. — M. le Dr. H. HICKMANN. — *Du battement des mains aux planchettes entrechoquées.*

L'invention des premiers instruments de musique est précédé par la "musique corporelle", le battement des mains et le frappement des pieds. Il sembles que les anciennes danses culturelles de l'Egypte pharaonique étaient accompagnées par ces rythmes simples, sans le concours d'autres instruments de musique.

Les planchettes entrechoquées, sculptées souvent en forme de mains humaines et fabriquées en bois ou en ivoire d'hippopotame représentent les instruments de percussion les plus archaiques de l'histoire musicale. Leur jeu continue la tradition préhistorique de la musique corporelle, notamment le battement des mains, mais leur emploi a laissé des traces sensibles dans la musique du peuple égyptien moderne.

3. — M. le Prof. A.H. NASR. — *Etudes phycosociologiques des algues marines de Ghardaqa.*

La station biologique de Ghardaqa est installée à la région tropicale du récif de corail, avec les espèces communes et melangées de corails croissants dans le récif voisin. La région recherchée s'est divisée en deux étages principaux dix étages littoral et sous littoral. Cette région est separée de la pleine mer par trois lignes parallèles de récifs de corail, ayant une diréction générale de NNO à SSE, charactéristique de la Mer Rouge. Chaque étage comprend sa propre association algologique. Dix associations ont été décrites pour la première fois à la Mer Rouge. Une liste de 112 espèces d'algues, avec leur répartition dans les étages différents a été donnée.

4. — M. le Dr. A. MONTASIR - and M. le Dr. FODA - *Distribution géographique, structure et reproduction de zygophyllum album L.*

Le zygophyllum album L, se trouve en grande quantité dans la plupart des régions phytogéographiques de l'Egypte. C'est une plante papillacées pubescente. Cette pubescence lui donne une couleur presque gris cendre. Cette plante qui est de la famille halophytique-xerophytique demande un terrain humide d'une capacité de saturation de 15%. Les feuilles du zygophyllum sont diphylles de forme oblongue de 4 à 8 m/m de longueur, portées sur une tige riche en sève de 5 à 15 m/m de longueur. Ses fleurs sont solitaires, hypogènes, régulières et hermaphrodites.

La pollinisation s'effectue par elle-même ou par les insectes. La dissection de cette plante a montré la présence de cristaux d'oxalate de calcium un peu partout. Ils sont solitaires ou en groupes.

La température est d'une grande influence sur la germination des semences, plus la chaleur est grande, plus la germination est intense. D'ailleurs les expériences de laboratoire ont démontré que la meilleure germination était celle du mois de juillet.

5. — M.A. SHATA. — *Les possibilités de trouver du petrole dans la région côtière de l'ouest de Sinai.*

Au cours des travaux de sondage exécutés par les sociétés pétrolières, ces quinze dernières années, cinq nouvelles nappes ont été découvertes à l'ouest du Sinai dans les zones suivantes : Sidr. Assal. Matarma. Wadi Firan. Balaim. Ces nappes souterraines couvrent une surface de 18 km 2, soit le 1/4% de la superficie de la région pétrolière.

D'après ces sondages nous pouvons diviser cette région en 4 sections de différents rendements :

1. — Zone de grand rendement 10% de la superficie totale.

2. — Zone de rendement moyen 55% de rendement moyen.

3. — Zone de rendement médiocre 35%.

4. — Zone sans rendement 1%.

INSTITUT D'EGYPTE

Séance du lundi 25 Avril 1955

Résumés des communications lues en séance

1. — M. le Prof. A. RIAD TOURKY. — *Le mécanisme de l'oxydation des métaux et ses défauts à la lumière de la nouvelle théorie.*

Les coefficients de température des électrodes de molybdène et de chrome étant mesurés dans des solutions libres, à l'origine des ions de ces métaux à haute valence, il a été trouvé que les électrodes de molybdène et de chrôme sont toujours surmontées par un effet de survoltage d'oxygène auquel peut être attribuée la passivité de ces métaux. La passivité est apparemment plus prononcée dans le cas du chrôme que dans celui du molybdène, vu que la surface de l'électro de recouverte par l'oxygène se monte aux 2/3 pour le premier et au 1/4 pour le second. Les diagrammes de T-Eo sont caractérisés dans les deux cas par des minima et des maxima dans les limites de température 15-50°c. Il a été relevé par le calcul thermo-chimique que l'oxyde de molybdène, qui est stable en contact avec le métal, est le pentoxyde.

2. — MM. N. BARAKAT & E.M. EL SHAZLY. — *Distribution spectrographique des éléments chimiques des dépots du plomb du zinc du plomb du zinc du cuivre et de l'or se trouvant dans les rochers d'Egypte.*

Il a été démontré par l'analyse spectrographique comparée que certains rochers d'Egypte tels que les calamines, les pyrites, les chalcopyrites contiennent des dépots de plomb, de zinc, de cuivre et d'or.

Ces résultats ont jeté une lueur sur la nature et les degrés calorifiques qui ont donné naissance à la formation rocheuses des dépôts minéraux, et ce, en les comparant à des travaux déjà exécutés à l'étranger.

3. — MM. RUSHDI SAID & TOSSON KAMEL. — *Foraminifères récents des littoraux de la côté égyptienne de la Méditerranée s'étendant de Rosette à Salloum.*

4. — M. le Prof. A. Riad Tourky lit sa communication "The Mechanisme of Oxidation of Metals in the Light of the New Theory of Lattice Defects.

5. — N.N. Barakat lit sa communication ??Spectrographic Distribution of Chemical Elements in Egyptian Minerals from Lead, Zinc, Copper and Gold Deposits".

6. — M. Tosson Kamel lit sa communication "Recent Littoral Foraminifera from the Egyptian Meditarranean Coast between Rosetta and Saloum" :

M. le Dr. S.A. Huzayyin prend la parole pour demander quelques précisions auxquelles répond M. Rushdi Said, co-auteur de la communication.

7. — M. le Prof. A. Grohmann lit sa communication "The Origin and Early Development of Floriated Hoûfi (Koufique fleuri).

Le Président lève la séance à 10 heures 20 p.m.

L'Institut se forme ensuite en Comité Privé.

Le Secretaire Général
CH. KUENTZ

SEANCE PUBLIQUE DU 25 AVRIL 1955

La séance est ouverte à l'Institut d'Egypte à 9 heures p.m.

SONT PRESENTS :

Bureau : MM. le Dr. S.A. Huzayyin *président*
le Prof. Sami Gabra ....*vice-président*
Ch. Kuentz ....*secrétaire général*
le Dr. I.G. Lévi ....*trésorier-bibliothécaire*
J.-Ph. Lauer ....*secrétaire adjoint*.

Excusé : M. le Prof. L. Keimer, vice-président.

MEMBRES TITULAIRES : MM. Bishr Farès, L. Christophe, J.-E. Goby, E. Greiss, A. Halawani, M.R. Madwar, Mohamed Mostafa, R.A. Tourky.

Excusé : M. le Dr. H. Hickmann.

MEMBRE ASSOCIE : M.A. Grohmann.

MEMBRES CORRESPONDANTS : MM. Abdel Rahman Zaki et G. Michailidis.

ASSISTENT A LA SEANCE : Mme A. Grohmann, MM. N. Barakat, G. Krotkoff et Mme, H. Lôwy, Pahor Labib, Rushdi Said, E.M. El-Shazly, Tosson Kamel.

1. — Le Secrétaire Général donne lecture du procès-verbal du 4 avril 1955, qui est approuvé.

2. — Le Président souhaite la bienvenue à M. le Prof. Ahmed Riad Tourky et M. le Dr. A. Halawani, nouveaux membres titulaires.

3. — Le Secrétaire Général présente des tirés à part offerts à à l'Institut par MM. C. Andreae, P. Balog et G. Michailidis.
Le Président remercie les donateurs.

Les auteurs ont entrepris la description de presque 82 espèces de Foraminifères qui vivent dans cette région littorale dont presque 50% de la famille Miliolidée.

On a constaté que les Foraminifères peuvent être divisés quant à leur origine en quatre provinces générales.

La première (formes autochtones) est celle qui comprend les espèces qui parurent à l'origine du Néogène en Méditerranée et qui n'ont céssé d'y être jusqu'à présent.

La deuxième (formes cosmopolites) comprend les espèces qui se trouvent actuellement dans toutes les mers, et dont l'origine n'est pas nécessairement la Méditerranée.

La troisième (formes Indo-Pacifiques) est celle qui comprend les espèces qui ont imigré de l'Océan Indien vers la Méditerranée dans l'ère pléistocène.

La quatrième est celle qui comprend les espèces qui immigrèrent de l'Ouest du Pacifique;

Les auteurs poursuivent une étude minutieuse du Foraminifère dans cette côte et dont les résultats seront publiés bientôt.

4. — M. le Prof. A. GROHMANN. — *L'origine et le premier développement du coufique fleuri*;

A l'encontre des deux théories suivant l'esquelles le coufique fleuri se serait développé dans l'Est (Turkistan) et serait ensuite passé en Mésopotamie, ou qu'il aurait été inventé en Tunisie et importé en Egypte par les Fatimites, l'auteur démontre que cette écriture de style décoratif est apparue en Egypte au moyen âge vers le milieu du III siècle de l'Hégire (IXe siècle ap. J.C.) Les premiers essais de cette écriture ont été décelés en Palestine à peu près 80 ans avant cette date.

L'idée de décorer la lettre avec des élements ou motifs fleuris présente un rapport étroit avec une décoration similaire déjà en usage dans les lettres grecques et peut-être les lettres coptes en connexion avec des traditions artistiques remontant à l'héritage hellénistique du IVe siècle ap. J.C.

INSTITUT D'EGYPTE

Séance du lundi 2 Mai 1955

Résumés des communications lues en séance.

1. — M. le Prof. Dr. MOHAMED SOBHY. — *Sur la greffe cornéenne en Egypte, expériences personnelles.*

Le Professeur Sobhy, l'un de nos grands spécialistes des greffes cornéennes, a fait à l'Institut d'Egypte une communication d'une remarquable clarté qui fut comprise même par le monde non médical.

Il souligna son exposé par plusieurs projections sur la Kératoplastie qui consiste à remplacer ou transplanter la cornée en totalité ou en partie.

2. — M.J. P. LAUER. — *Sur le choix de l'angle de pente dans les pyramides d'Egypte.*

M.J. Lauer reprend la question de savoir si les architectes des pyramides obéirent pour le choix des angles de pente de ces monuments géométriques à des considérations mystiques ou symboliques, ou s'ils furent plus simplement guidés par des raisons d'ordre esthétique ou technique. Il réfute les idées émises autrefois par Jomard, s'appuie sur les récentes mesures effectuées à la pyramide "rhomboidale" au cours des fouilles dirigées par le Professeur Ahmed Fakhry, qui apportent des correctifs aux données de Perring datant de plus d'un siècle. Ces correctifs s'exerçant dans le sens qu'il avait prévu dans son ouvrage sur "Le Problème des Pyramides d'Egypte" M. Lauer estime qu'ils apportent un nouvel argument en faveur de sa thèse soutenant que les architectes recherchaient des angles de pente aisément constructibles et contrôlables, c'est-à- dire, dont les tangentes trigonométriques correspondaient à des rapports numériques aussi simples que p s ble.

3. — F. DEBONO. *La civilisation prédynastique d'El-Omari (Nord d'Helouan) Nouvelles données.*

Bien que plusieurs campagnes aient été effectuées par nous, les caractères de cette civilisation sont loin de nous être complètement révélés. Nos dernières recherches ont fourni des documents permettant de réviser quelques-unes de nos dernières conclusions.

SEANCE PUBLIQUE DU 2 MAI 1955

La séance est ouverte à l'Institut d'Egypte à 9 heures p.m.

SONT PRESENTS :

Bureau : MM. Dr. S.A. Huzayying ...... *président.*
le Prof. Sami Gabra ... *vice-président*
J.-Ph. Lauer .... *secrétaire-adjoint*

Excusés : M. le Prof. L. Keimer, vice-président, M. Ch. Kuentz, secrétaire général, M. le Dr. I.G. Lévi, trésorier-bibliothécaire.

MEMBRES TITULAIRES : MM. A. Alfiéri, Ch. Avierinos, Bishr Farès, L. Christophe, K.O. Ghaleb, P. Ghalioungui, J.-E. Goby, R. Godel, E, Greiss, O. Guéraud, H. Hickmann, M.R. Madwar, Mohamed Kamel Hussein, Mohamed Mostafa, Ismail Ratib, Mohamed Sobhy, A.R. Tourky.

Excusé : M. Mansour Fahmy.

MEMBRE CORRESPONDANT : M. Abdel Nabi El-Nahas.

ASSISTENT A LA SEANCE : Mme Débono, Mme Goby, Mme Senn-Ayrout, Mme Ragher, MM. Debien, F. Débono, R. Ellis, Jean Sainte Fare GARNOT, A. Harrari, H. Lowy, R. Mosséri.

Excusé : S.E. l'Ambassadeur de France.

1. — Le Secrétaire-Adjoint donne lecture du procès-verbal du 25 avril 1955, qui est approuvé.

2. — Le Secrétaire-Adjoint présente des tirés à part offerts à l'Institut par MM. J.-Ph. Lauer et M.J. Boulos Simaika.
Le Président remercie les donateurs.

3. — M. le Prof. Mohamed Sobhy lit sa communication "sur la greffe cornéenne en Egypte, expériences personnelles".

4. — M.J.-Ph. Lauer lit sa communication "Sur le choix de l'angle de pente dans les pyramides d'Egypte".

5. — M.F. Débono lit sa communication "La civilisation prédynastique d'El-Omari (Nord d'Hélouan). Nouvelles données".
M. le Dr. S.A. Huzayyin prend la parole pour féliciter l'auteur et ajouter quelques remarques.

Le Président lève la séance à 10 heures 20 p.m.
L'Institut se forme ensuite en Comité Privé.

Le Secrétaire-Adjoint
J.-PH. LAUER

طبع بمطابع
دار النشر للجامعات المصرية
علاء الدين الشيتي وشركاه (شركة توصية بالأسهم)
٤٤ شارع شريف - بالقاهرة

٤ — قرأ المسيو لاوير محاضرته عن حول اختيار زوايا ميل الأهرامات فى مصر .

٥ — قرأ المسيو دبيونو محاضرته عن مدنية عصر ما قبل الأسرات فى منطقة العمر .

وأبدى الدكتور سليمان حزين ملاحظات وهنأ المحاضر .

وانتهى الاجتماع الساعة ١٠ وثلث . ثم عقد المجمع جلسة خاصة .

ملخص المحاضرات

التى ألقيت بجلسة ٢ مايو سنة ١٩٥٥

١ — الدكتور محمد صبحى — حول عملية ترقيع القرنية فى مصر

ألقى الدكتور محمد صبحى محاضرته القيمة . ولما كان الدكتور صبحى من أساطين الطب القلائل المختصين بهذه العملية فى مصر فقد عزز محاضرته بعرض صور ورسومات فألقى كثيراً من الضوء العلمى لتنوير الأوساط غير المشتغلة بالطب ثم تصدى للتجارب والعمليات التى صادفته وشرح باسهاب الطرق العملية والطبية المختلفة المتعلقة باستبدال قرنية بأخرى أو نقلها من عين إلى عين .

٢ — المسيو ج. ف . لاوير — حول اختيار زوايا ميل الأهرامات فى مصر

تكلم المسيو لاوير عما إذا كان مهندسو الأهرامات قد بنوا نظريتهم فى مصر زوايا ميل هذه الآثار الهندسية على تقديرات رمزية أو عقيدية أم أنهم سلكوا الطرق المبسطة المبنية على التناسق الفنى . ولقد عارض أفكار جومار مؤكداً أن هذه الزوايا تخضع لقوانين الهندسة الفراغية فى أبسط حساباتها .

٣ — المسيو ف . ديبونو — مدنية عصر ما قبل الأسرات فى منطقة العمرى (شمال حلوان) آراء جديدة بالرغم من الحفريات العديدة التى قمنا بها لم نستطع الوقوف على خصائص هذه المدنية بصفة كاملة . وحفرياتنا الأخيرة خولت لنا إيضاح بعض النقط التى كنا وصلنا إليها سابقاً .

تركستان ثم نقل إلى بلاد الشرق الأوسط أو أنه نبت فى تونس ثم أدخل إلى مصر بواسطة الفاطميين فان المعروف إن هذا الطابع المزخرف للكتابة وجد فى مصر فى أواسط القرن الثالث الهجرى (القرن التاسع الميلادى) .

وقد عثر على أول محاولات لزخرفة هذا الخط فى فلسطين حوالى ٨٠ سنة قبل التاريخ المذكرر . ونجد وجه الشبه بين فكرة تجميل الخط الكوفى بادخال وحدات زخرفية عليه وبين الزخارف الخطية التى كانت تستعمل فى بلاد اليونان وفى الخط القبطى .

الجلسة العلنية فى ٢ مايو سنة ١٩٥٥

عقد الاجتماع بدار المجمع فى الساعة ٩ مساء بحضور السادة المحترمين :

مجلس الإدارة :

الدكتور سليمان حزين .... الرئيس
الدكتور سامى جبره .... نائب الرئيس
المسيو ج . ف . لاوير .... السكرتير المساعد

واعتذر السادة : كيمر نائب الرئيس وكونس السكرتير العام وليفى أمين الصندوق والمكتبة :

أعضاء عاملون: السادة الفيرى . أفرينو . بشر فارس . كريستوف كامل عثمان غالب . غاليونجى . جوبى جوديل . جريس . جبرو . هيكمان . محمد مدور . محمد كامل حسين . محمد مصطفى . اسماعيل راتب . محمد صبحى . أحمد رياض تركى .

واعتذر الدكتور منصور فهمى .

أعضاء مراسلون : عبد النبى النحاس .

المدعوون : مدام جوبى . مدام سن . مدام تاجر . السادة ديبونو . دبيين ر . الياس . جان سان فارجارنو . هرارى . لوفى . موسيرى .

واعتذر سعادة وزير فرنسا المفوض فى مصر .

١ — قرأ السكرتير المساعد محضر جلسة ٢٥ أبريل ١٩٥٥ ثم ووفق عليه .

٢ — عرض السكرتير المساعد النبذ المهداة إلى المجمع من السادة لاوير . بولس . سميكا وشكرهم الرئيس .

٣ — قرأ الدكتور محمد صبحى محاضرته عن عملية ترقيع القرنية .

٥ — ألقى الدكتور بركات محاصرته عن « التوزيع الطيفى للعناصر الكيمائية فى رواسب الرصاص والزنك ... » .

٦ — ألقى السيد طوسون كمال محاضرته عن « فورا مينفيرا البحر الأبيض المتوسط للشاطىء الممتد من رشيد ... » .

٧ — ألقى الأستاذ جرومان محاضرته عن « أصل وسرعة تطور الخط الكوفى المزخرف » .

وانتهى الاجتماع فى الساعة ٢٠ر١٠ مساء ثم عقد المجمع لجنة خاصة .

السكرتير العام

ش . كونس

ملخص المحاضرات

التى ألقيت بجلسة ٢٥ أبريل سنة ١٩٥٥

١ — الدكتوران بركات والشاذلى — التوزيع الطيفى للعناصر الكميائية فى رواسب الرصاص والزنك والنحاس والذهب فى الصخور المصرية .

تم بواسطة التحليل الطيفى المقارن معرفة توزيع العناصر الكميائية فى بعض الصخور المصرية كالجالينا والسفالريت والكالكوسيت والبريت « والكالمين » والولفينيت والجوسلريت فى المواطن المعروفة للرصاص والزنك والنحاس والذهب فى مصر وذلك باستخدام مطياف هيلجر من نوع الليترو . ولقد ألقت النتائج التى حصل عليها ضوءاً على طبيعة ودرجة الحرارة التى تم عندها التكوين الصخرى للرواسب المعدنية وذلك بمقارنتها بنتائج سابقة فى بلاد أجنبية .

٢ — الدكتوران ر . سعيد و ط . كامل — فورا مينفيرا البحر الأبيض المتوسط للشاطىء الممتد من رشيد إلى السلوم .

قام المحاضران بوصف حوالى ٨٢ نوعا من الفورامينيفرا التى تعيش فى المنطقة الساحلية حوالى ٥٠ ٪ من عائلة المليوليدى . وقد لاحظا أن الفورامينيفرا يمكن تقسيمها من حيث أصولها إلى أربعة أقسام عامة هى :

القسم الأول الذى يحتوى على الأنواع التى نشأت أصلا فى نيوجين البحر المتوسط واستمر فيه حتى الآن . والقسم الثانى المكون من الأنواع التى توجد الآن منتشرة فى جميع بحار العالم والتى قد لا يكون أصلها البحر المتوسط . والقسم الثالث الذى يحتوى على الأنواع التى هاجرت من شرق الباسفيكى . وقد ضرب المحاضران لذلك عدة أمثلة . وهما يقومان الآن بدراسة إحصائية للفورامينيفرا فى هذا الشاطىء الممتد من رشيد إلى السلوم والبالغ طوله ٦٥٠ كم .

٣ — المسيو جروهمان — أصل وسرعة تطور الخط الكوفى المزخرف .

لإيضاح النظريتين القائلتين بأن الخط الكوفى المزخرف جاء فى شرق

فى مجموعها مساحة تقدر بحوالى ١٨ كيلومتر مربع أى ما يعادل ١/٤ ٪ من المساحة المحتمل وجود البترول فيها .

ولقد كشفت تلك الأبحاث أيضاً النقاب عن كثير من الحقائق المتعلقة بالوضعين الاستراتجرافى والتركيبى وهما متصلين اتصالا وثيقاً بمنشأ البترول وتجمعه . وعلى ضوء تلك الحقائق أمكن تقسيم تلك المنطقة إلى أربعة أقسام فى إمكانياتها كمصدر للبترول :

أولا — مناطق ذات إمكانيات كبيرة وتشغل حوالى ١٠ ٪ من مجموع المساحة .

ثانياً — مناطق ذات إمكانيات متوسطة وتشغل حوالى ٥٥ ٪ من مجموع المساحة .

ثالثاً — مناطق ذات إمكانيات طفيفة وتشغل حوالى ٣٥ ٪ من مجموع المساحة .

رابعاً — مناطق لا إمكانيات لها وتشغل أقل من ١ ٪ من مجموع المساحة .

الجلسة العلمية فى ٢٥ أبريل ١٩٥٥

عقد الاجتماع بدار المجمع العلمى المصرى فى الساعة ٩ مساء بحضور السادة المحترمين.

مجلس الإدارة :
الدكتور سليمان حزين .... الرئيس
الأستاذ سامى جبره .... نائب الرئيس
المسيو شارل كونس .... السكرتير العام
الدكتور ا . ج . ليفى .... أمين الصندوق والمكتبة
المسيو لاوير .... السكرتير المساعد

واعتذر الأستاذ ل . كيمر .

أعضاء عاملون : بشر فارس . كريستوف . جوبى . إلهامى جريس . أحمد الحلوانى . محمد رضا مدور . محمد مصطفى . أحمد رياض تركى .

واعتذر الدكتور هيكمان .

أعضاء منتسبون : جرومان .

أعضاء مراسلون : عبد الرحمن زكى . ميخاليدس .

المدعوون : مدام جرومان . مدام بركات . كروتكوف والمدام . لوفى باهور لبيب . رشدى سعيد . الشاذلى محمد الشاذلى . طوسون كمال .

١ — قرأ السكرتير العام محضر جلسة ٤ أبريل ١٩٥٥ ثم ووفق عليه .

٢ — رحب الرئيس بكل من الآستاذين أحمد رياض تركى وأحمد الحلوانى العضوين الجديدين .

٣ — عرض السكرتير العام النبذ المهداة إلى المجمع من السادة : أندريه . بالوج . ميخاليدس . وشكرهم الرئيس .

٤ — ألقى الدكتور رياض تركى محاضرته عن « صدأ المعادن على ضوء النظرية الجديدة لعيوبه) .

ملخص المحاضرات

التى ألقيت بجلسة الاثنين ٤ ابريل ١٩٥٥

١ — السيد حسن عبد الوهاب : تخطيط مدينة القاهرة وتنظيمها منذ نشأتها (باللغة العربية) .

موضوع محاضرة ألقاها أمس بالمجمع العلمى المصرى السيد حسن عبد الوهاب كبير مفتشى الآثار الإسلامية تناول فيها تأسيس القاهرة وكيف روعى فيها النظم الحديثة للتخطيط من إيجاد ميادين وشوارع متسعة محورها القصر الكبير . وقال إن المدن الإسلامية روعى فيها عند تخصيصها تعليمات عمر ابن خطاب التى حدد فيها سعة الشوارع الرئيسية والميادين والأزقة . وأشار إلى أن المشرع الإسلامى وضع قوانين التنظيم من البناء على خط التنظيم وعدم إقامة مبانى أومساطب تعوق السير . وحرم سد الطريق المسدود ولوكان بناء مسجد . وأعطى المحتسب سلطة تنفيذ تلك التعليمات وإزالة المخالفات فكانت لديه سلطة البلدية الآن .

ثم تحدث بافاضة عن النظم التى وضعت لإضافة الشوارع والأسواق ونظافتها وتمهيد الطرق ونزع الملكية وإطفاء الحريق وتجميل القاهرة بازالة خرائبها وإقامة جدران على بعض الخرائب لسترها عن العيون وتقسيم القاهرة إلى مناطق سكنية وصناعية . وأن مصر استعملت البطاقات الشخصية ورقمت الدور ووضعت لافتات بأسماء الشوارع منذ قرن ونصف .

وعرض مجموعة طريفة من الصور الفوتوغرافية والمصورات الجغرافية وهو موضوع طريف لم يطرق من :

٢ — الدكتور عبد الحليم نصر : توزيع الطحالب البحرية فى الغردقة (البحر الأحمر) .

تقع محطة الأحياء البحرية بالغردقة فى منطقة الشعاب المرجانية التابعة للمنطقة الحارة وتتميز بأنواع من المرجانيات تنمو مختلطة مع بعضها على الشعاب المجاورة للمحطة . وتنقسم المنطقة إلى جزءين رئيسيين هما الحزام المدى والحزام تحت

المدى ويصلها عن باقى البحر المتسع ثلاث خطوط من الشعاب المرجانية المتوازية تمتد فى اتجاه شمالى الشمال الغربى إلى جنوب الجنوب الشرقى مما يتميز به البحر الأحمر ولقد وجد إن ذلك حزام عشائرة الطحلبية كما وصفت حوالى عشر عشائر جديدة للبحر الأحمر مع بيان قائمة بتوزيع ماربو على المائة من أنواع الطحالب فى الأعماق المختلفة من البحر الأحمر .

٣ — الدكتور ع . ا . منتصر والدكتور هـ . ا . فوده : التوزيع الجغرافى والتركيب التشريحى فى نبات البول .

نبات « البول » نبات منتشر فى مصر فى معظم المناطق الجغرافية النباتية . وهو نبات حلمى مغطى بزغب ناعم يغطيه لونا أقرب إلى الرمادى . وهو نبات معمر غير منتظم التفرع ينتمى إلى المجموعة الملحية الصحراوية . ويعتبر المحتوى المائى للتربة من أهم العوامل فى نموه وانتشاره وتبلغ جذوره ذروة نموها فى التربة التى تحتوى ١٥ ٪ من درجة تشبعها . وتقل مقدرة النبات على اختراق التربة بزيادة محتواها المائى . وأوراق « البول » مركبة من زربقتين كل واحدة مثل الحرية المقلوبة أو قريبة من البيضة أو اهليليجية مستديرة الحافة ويبلغ طولها من ٤ — ٨ مليمتر محمولة على عنق غليظ عصيرى يبلغ طوله من ٥ — ١٥ مليمتر. وأزهار البول محورية وحيدة سلفية منتظمة خنثى والتلقيح إما ذاتى أو خلطى بواسطة الحشرات وقد لوحظ فى دراسة التركيب التشريحى أن بللورات اكسالات الكالسيوف منتشرة فى أجزائه المختلفة أما وحيدة أو متجمعة وقد وجد إن لدرجة الحرارة تأثيراً هاماً على نسبة الإنبات فتزداد الأخيرة بزيادتها وقد كان أنسب شهر للإنبات فى المعمل هو شهر يوليه .

٤ — الدكتور عبده شطا — احتمالات وجود البترول فى المنطقة الساحلية بغرب سينا .

فى خلال الخمسة عشر سنة الماضية أسفرت الأبحاث التى قامت بها شركات البترول فى مصر عن كشف خمس حقول جديدة كلها مركزة فى المنطقة الساحلية بغرب سينا وهى : سدر وعسل ، ومتارما ، ووادى فيران والبلاعيم . والبترول المكتشف فى هذه الحقول الخمس يوجد فى مصائد صغيرة تشغل

الجلسة العلنية فى ٤ أبريل ١٩٥٥

عقد الاجتماع بدار المجمع المصرى فى الساعة ٦ مساء بحضور السادة المحترمين : —

مجلس الإدارة .

الأستاذ . ل . كيمر والدكتور سامى جبره ... نائبا الرئيس
المسيو شارل كونس .... السكرتير العام
الدكتور ليفى .... أمين الصندوق والمكتبة
المسيو لاوير .... السكرتير المساعد
واعتذر الدكتور سليمان حزين .... الرئيس

أعضـــاء عاملون .

أفرينو . بالوج . بشر فارس . رينيه قطاوى . كريستوف . حسن شاكر أفلاطون . كامل عثمان غالب . الهامى جريس . يونجفليش . محمد مدور . محمد كامل حسين . محمد كامل مرسى . محمد مصطفى . اسماعيل راتب .

أعضـاء مراسلون .

عبد الفتاح حلمى . عبد المحسن الخشاب . عبـد الرحمن زكى . حسن عبد الوهاب . ابراهيم المويلحى . ميخاليدس .

المـدعوون .

مدام تكهولم . السادة سان فارجارنو . حسين راشد . كامل يسرى . لوفى . مارزينى . الشيخ محمد عثمان . عبده شطا . زكور . محمود رياض .

١ — قرأ السكرتير العام محضر جلسة ١٤ مارس ١٩٥٥ ثم ووفق عليه .

٢ — عرض السكرتير العام النبذ المهداة إلى المجمع من السادة كريستوف ولاوير وشكرهم نائب الرئيس .

٣ — ألقى السيد حسن عبد الوهاب محاضرته عن « تخطيط مدينة القاهرة وتنظيمها منذ نشأتها » وأبدى الدكتور بشر فارس بعض الملاحظات .

٤ — أعلن نائب الرئيس اعتذار الدكتور هيكمان عن إلقاء محاضرته بسبب مرضه

٥ — قرأ الدكتور فوده محاضرته عن « التوزيع الجغرافى والتركيب التشريحى فى نبات البوال » وأبدت مدام تكهولم والدكتور كيمر بعض الملاحظات .

٦ — قرأ الدكتور عبد الحليم نصر محاضرته عن توزيع الطحالب البحرية فى الغردقة .

٧ — قرأ الدكتور عبده شطا محاضرته عن « احتمالات وجود البترول فى المنطقة الساحلية غرب سينا .

وانتهى الاجتماع الساعه ٧٫٢٠ مساء ثم عقد المجمع لجنة خاصة .

السكرتير العام

ملخص المحاضرات

التى ألقيت بجلسة الإثنين ١٤ مارس ١٩٥٥

١ — المسيو ل. م. كريستوف : تاريخ ضيف القاهرة الجديد تمثال رعمسيس الثانى .

رأى قائد الجناح عبد اللطيف البغدادى أن ينقل تمثال رعمسيس الثانى من مرقده بين نجيل مدينة منف إلى القاهرة .

ويرجع اكتشاف هذا التمثال المصنوع من الجرانيت إلى (هورنو) خلال شتاء ١٨٥٣ — ١٨٥٤ . وفى سنة ١٨٨٧ قام الصاغ (إرثر باجنولد) بازاحة الأتربة عنه ووضعه فوق تل صناعى صغير لمنع تسرب رشح المياه إليه .

وقد تم نحت هذا التمثال لرمسيس الثانى فى محاجر أسوان (الأسرة التاسعة عشرة) وقد نقش عليه رسم إبنته التى هى زوجته فى نفس الوقت « بنت — أنطا » وكذلك رسم لأمير صغير مجهول الإسم .

وفى عهد الأسرة العشرين أمر رمسيس الرابع بازالة إسم رمسيس الثانى من على التمثال ونقش إسمه هو بدله فى كل مكان وجد فيه .

وهكذا فان هذا التمثال الذى سيقام فى ميدان محطة القاهرة لا يحمل إسم رمسيس الثانى . ولـكن الملكة الصغيرة المنقوشة عليه تنبىء عن الزمن الذى تم فيه نحت التمثال ووضع معبد بتاح تحت فى مدينة منف .

٢ — المسيو سبوننبرج (قراءة الدكتور اسكندر بدوى) : أثر الطابع المصرى فى صناعة نحت التماثيل بالولايات المتحدة .

شرح للتأثيرات لفن النحت المصرى على إخراج النحاتين فى الولايات المتحدة وبرهان على أن بعد قرن من التقليد ظهرت قطع حديثة تدل على تفهم روح النحت المصرى .

٣ — الدكتور مصطفى عبد العزيز والدكتور محمد صابر نعيم — التفسير السولوجى لمقاومة وقابلية الإصابة لمرض الذبول فى بعض أصناف القطن .

للدلالة الفسيولوجية للمقاومة وقابلية الإصابة بمرض ذبول الفيوزاريوم فى بعض أصناف القطن المصرى ٢) تأثير المنتجات الأيضية الفطرية على نمو القطن وطريقة الإصابة .

يهدف هـذا البحث نحو دراسة تأثير المنتجات الأيضية الفطر فيوزاريام المسبب لمرض ذبول القطن على قوة نمو الأصناف المختلفة من القطن كما يحتوى على دواسة الطريقة التى ينفذ بها القطر إلى داخل البادرات فى صنف « جيزة ٢٦ » القابلة للإصابة بالذبول وصنف « كرنك » المقاوم نسبياً .

الجلسة العلنية فى ١٤ مارس ١٩٥٥

عقد الاجتماع فى الساعة ٦ مساء بدار المجمع العلمى المصرى بحضور السادة المحترمين :

مجلس الإدارة :

الأستاذ كيمر	نائب الرئيس
المسيو كونس	السكرتير المساعد
الدكتور ليفى	أمين الصندوق والمكتبة

واعتذر الدكتور سليمان حزين الرئيس والدكتور سامى جبرة نائب الرئيس .

أعضاء عاملون :

الأب قنواتى . الفيرى . حلمى بهجت بدوى . بالوح . بشر فارس . ر . قطاوى كريستوف . حسن شاكر أفلاطون . كامل عثمان غالب . جوبى . جوديل . إلهامى جريس . هيكمان . يونجفليش . لاوير . محمد مدور . منصور فهمى . محمد كامل حسين . محمد مصطفى . هنرى موصيرى . اسماعيل راتب .

واعتذر الدكتور مصطفى عامر والدكتور مراد كامل والدكتور طه حسين .

أعضاء مراسلون :

عبد المحسن الخشاب . اسكندر بدوى . ميخاليدس .

المدعون :

مدام كريستوف . مدام حالاس . مدام ومدموزيل دى كامب . مدام تاكهولم . مدام تاخر . مدموازيلات ضيا أبو غازى . غالى . ميخاليدس . والسادة أرنالديز . بوتمر . دينو . سان فار جارنو . مأمون غنيم . حجار . خاطر . لا جانا . لاجونكوم . لوفى . مارزينى . موسكاتيللى . ماشارد . موصيرى . مصطفى عبد العزيز . م . س . نعيم . سوفستر . فيكنتيف . فنسنو والمدام .

١ — أقر السكرتير العام محضر جلسة ٧ فبراير ١٩٥٥ تم ووفق عليه .

٢ — هنأ نائب الرئيس الدكتور حلمى بهجت بدوى العضو العامل الجديد ورحب به .

٣ — هنأ نائب الرئيس :

(ا) الدكتور محمد كامل حسين لتعيينه عضواً بمجلس إدارة مينة جامعة القاهرة.

(ب) الدكتور عبد الحميد بدوى لانتخابه وكيلا لمحكمة العدل الدولية فى لاهاى .

(ج) الدكتور بشر فارس لتعيينه عضو بجماعة الفنون الدولية وانتخابه رئيساً للقسم المصرى بجماعة الفنون الدولية لدى المؤتمر الدولى الخامس لهذه الجماعة الذى سينعقد باستنبول .

(د) الأستاذ عثمان رفقى رستم لتعيينه عضواً بجماعة الفنون الدولية .

٤ — عرض السكرتير العام النبذ والأبحاث المهداة إلى المجمع من السادة : كوفيبه . فوتتين . يانسن . يونجلفليش . وقد شكرهم نائب الرئيس .

٥ — قرأ المسيو كريستوف محاضرته عن « تاريخ ضيف القاهرة الجديد — تمثال رمسيس الثانى » . ثم عرض المسيو لاوير بعض الصور لعملية نقل التمثال .

٦ — قرأ الدكتور اسكندر بدوى محاضرة الأستاذ سبوننباخ عن « أثر الطابع المصرى فى صناعة نحت التماثيل » .

٧ — قرأ الدكتور نعيم محاضرته عن « التفسير الفسيولوجى لمقاومة وقابلية الأصابة لمرض الذبول » .

وأنهى نائب الرئيس الاجتماع الساعة ٢٠ر٧ مساء ثم عقد المجمع لجنة خاصة.

السكرتير العام

ملخص المحاضرات

التى ألقيت بجلسة يوم الاثنين الموافق ٧ فبراير سنة ١٩٥٥

١ — المسيو جوبى : مشاريع الخزانات فى مصر فى القرن التاسع عشر :

تناول المحاضر إنشاء خزان أسوان الذى استغرق بناؤه من ١٨٩٨ — ١٩٠٢ ويؤكد العالم الفرنسى أن المهندسين لاموت وكوب وايتهاوس واسكندر برومت كانوا أول من درس من ١٨٨٠ — ١٨٩٠ إمكانيات إقامة خزان ضخم منظم لتصريف مياه النيل نظراً للفوائد الجمة التى تعود منه على البلاد . وفى فترات أخرى طرأت على لينان دى بلفون ولايوت وجاكى فكرة إقامة خزان عند السلسلة . أما وايتهاوس فانه كان أول من رأى تحويل منخفض وادى الريان إلى خزان لمياه النيل بيد أن برومت واسكندر نول أشارا باقامة الخزان فى كلابشة . وبعد سنوات عديدة من البحث والدرس قدم المهندس الكبير وليام ولكوكس مشروع خزان أسوان لم يزل يدر على اقتصاديات مصر النفع العميم .

٢ — المسيو فارجارنو — ملحوظات خاصة ببعض أسماء ملوك الأسر المصرية الثلاث الأولى .

معظم أسماء ملوك الأسر المصرية الثلاث الأولى لهم معنى . فالبعض يدل على صفقة للملك والبعض الآخر على أشهار اعتقاد دينى . ففى الفئة الأولى تدخل أيضاً أسماء هوروس دجوسير (الأسرة الثالثة) واسم الفرعون الذى من أجل الهرم المدرج الذى أكتشفه أخير الدكتور زكريا غنيم هذه الأسماء كلها أسماء تفصيل ومعناها (الأكثر قداسة أو الأكثر قوة) من طائفة الآلهة . والفئة الثانية تشمل خصوصاً « أسماء توفيق » (أو ممتسكين) التى تعللى تدين بعض الفراعنة للآلهة) المنافسة ، وروس وست يجب إضافة اسم « ست » برينس (الأسرة الثانية) إلى القائمة القديمة . كما يجب مقارنة هذا الملك — كما اقترح قديماً — بهوروس سخم آب .

٣ — الدكتور عبد العزيز عثمان — دراسة تتابع طبقات التكاوين التابعة لما قبل العصر الجيولوجى الثالث والموجودة تحت السطح بمنطقة أبى رواش .

تقع منطقة أبى رواش على بعد خمسة كيلو مترات غربى القاهرة وثمانى كيلو مترات إلى الشمال الغربى لأهرامات الجيزة . ولقد اعتمد الكاتب فى هذه الدراسة على تحليل العينات المستخرجة من البكر رقم ١ للذى قامت بحفره فى منطقة أبى رواش شركة ستاندرد للبترول ولقد أمكن بواسطة دواسة الحفريات الدقيقة التى تحتويها هذه العينات تقدير أعمار طبقات التكاوين المختلفة الموجودة تحت السطح فى هذه المنطقة وكذلك تقسيمها إلى عدة مناطق كل منها يتميز بمميزات حفرية خاصة . ولقد عقد الكاتب فى نهاية هذا البحث مقارنة بين تكاوين العصر الجوارس بمنطقة ابن رواش بنظيراتها فى جبل مغارة بشمال شرقى سيناء .

الجلسة العلنية فى ٧ فبراير سنة ١٩٥٥

عقد الاجتماع بدار المجمع العلمى المصرى فى الساعة ٦ مساء وكان الحاضرون السادة المحترمين :

مجلس الإدارة :

الدكتور سليمان حزين................ الرئيس
الأستاذ ل . كيمر .... } نائبا الرئيس
الدكتور سامى جبره ....
المسيو شارل كونس................ السكرتير العام
واعتذر الدكتور ا . ج . ليفى ...... أمين الصندوق والمكتبة

أعضاء عاملون : الأب قنواتى . الفيرى . محمود ابراهيم عطية . افرينو . بالوج . بشرفارس . رينيه قطاوى . خريستوف . جوديل . كامل عثمان غالب . غاليونجى . جوبى إلهامى جريس . جيرو . حامد زكى . هيكمان . يونجلفيش . لاوير محمد رضا منور . محمد كامل حسين . محمد مصطفى . مصطفى عامر . اسماعيل راتب . عثمان رفقى رستم . محمد صبحى . طه حسين .

أعضاء منتسبون :

جروهمان . ماسينو .

أعضاء مراسلون :

عبدالمحسن الخشاب . عبد الرحمن زكى . اسكندر بدوى . حسن عبد الوهاب . ابراهيم المويلحى . ميخاليدس .

المدعوون :

مدام سانفارجارنو . مدام جوبى . مدام جيرو . مدام سامى جبره . السادة عبد العزيز عثمان . دافينو . ديبين . سان فارجارنو . غالى وكريمته . كروتكون . لاجانا . لوفى . مازرينى . نجيب بولس باهورلبيب . على شافعى . فينزويللو والمدام . زكى نور .

١ — قرأ السكرتير العام محضر جلسة ١٠ يناير ١٩٥٥ ثم ووفق عليه .

٢ — قدم الرئيس شكره للسادة الأعضاء على انتخابهم له رئيساً لسنة ١٩٥٥ — ١٩٥٦ .

٣ — أبلغ السكرتير العام الأعضاء أنه يمكن قبول وطبع محاضرات مختلفة وأن الرغبة متجهة إلى إشراك أساتذة الجامعات فى عمل محاضرات يقوم المجمع بطبعها على ألا تتعطل أعمال المجمع الجارية حالياً .

٤ — هنأ الرئيس الدكتور بشر فارس على انتخابه عضو شرف بالجمعية التركية للتاريخ والطب .

٥ — أعلن الرئيس وفاة الأستاذ أزرب العضو العامل منذ فبراير ١٩٣٧ . وأعلنت دقيقة صمت .

٦ — عرض السكرتير العام العدد الجديد من المجلة الجزء ٤٦ وكذلك الأبحاث المهداة للمجمع من السادة : الفيرى . بشر فارس . شاكر أفلاطون . غيجى . ابراهيم المويلحى . يونجفليش . منرو دومين وشكرهم الرئيس .

٧ — ألقى المسيو جوبى محاضرته عن « مشاريع الخزانات فى مصر فى القرن التاسع عشر » .

٨ — ألقى المسيو فارجارنو محاضرته عن « ملاحظات على بعض أسماء ملكية لأول أسرتين مصريتين » .

٩ — ألقى الدكتور عبد العزيز عثمان محاضرته عن « التكاوين الاستراتيجرافية غير الظاهرة . . . » .

وانتهى الاجتماع الساعة ٧٫٤٠ مساء ثم عقد المجمع لجنة خاصة .

١ — تعيينه عضو مراسل فى لجنة الموسيقى بالمعهد الملكى لعلم الإنسان بلندن .

٢ — تعيينه عضو مراسل بمعهد الآثار الألمانى ببرلين .

٣ — عرض السكرتير العام النبذ المهداة إلى المجمع من السادة : اسكندر بدوى . شركة قنال السويس . خريستوف . داللونى هيللر . يونجفليش . محمد مدور . مالز . محمد مصطفى . سبونبرج . وقد شكرهم الرئيس .

٤ — قرأ الأستاذ كيمر محاضرته عن « الأمة الصغيرة والفهد » .

٥ — قرأ الدكتور رياض جندى محاضرته عن « صخور أسوان النارية والمتحولة » وانتهى الاجتماع الساعة ٢٠ر٧ مساء ثم عقد المجمع لجنة خاصة .

السكرتير العام

ملخص المحاضرات

التى ألقيت بجلسة الاثنين ١٠ يناير ١٩٥٥

١ — الأستاذ ل . كيمر : الأمة الصغير والفهد . من تمثال صغير مصنوع من الصينى المموه بالمينا من العصور المتأخرة .

كان عند المرحوم اشل جروبى تمثال صغير أنيق مصنوع من الصينى المموه بالمينا من العصور المتأخرة (ربما العصر البوباستى) والتمثال يمثل أمة صغيرة (ذات طابع أسيوى) تحمل فوق ظهرها فهداً (سور أو نمر للصيد) يعتبر — بلا منازع — من أظرف فصيلة الفهود .

وقد استأنس النمر (أو السنور) مع الفهد مدة طويلة ولكن الأخير لعب دوراً بالمساعدة فى أعمال الصيد . وكان الفهد فى عهد قدماء المصريين هو حيوان « الشمال » أما النمر الحقيقى فكان من الجنوب . وقد استوطن الفهد فى الأزمة الحديثة مناطق غرب الإسكندرية مما يدل على أنه كان يقطن الجهات الشمالية من القطر . وقد رحل السنور عن منذ زمن طويل ولكنه استوطن سينا وهى جزء من الحدود المصرية التى كانت بالنسبة لقدماء المصريين كأنها قطر أجنبى وتمثال اشيل جربى من وجهة النظر الفنية يعتبر تحفة عظيمة .

٢ — الدكتور ا . ر . جندى : صخور أسوان النارية والمتحولة .

أقد صخور أسوان هى صخور شستية ميكائية ذات أصل رسوبى تداخلت فيها عند بدء التقلصات الأرضية صخور نارية قاعدة على هيئة طبقات وسدود ثم تعرض هذان النوعان من الصخور لا ندفاع سوائل حمضية مل الأعماق أثناء وبعد التقلصات ونتج من تفاعيل الجمع كمائياً فى كثير من الأمكنة جرانيت أسوان ذو الحبيبات الكبيرة . وعلى ذلك يكون هذا الجرنيت قد تكون أصلا فى مكانه بأن حل الصخور نتيجة للتفاعلات . ويلى هذا الجرنيت سدود وعروق من جرانيت آخر ذو حبيبات دقيقة ثم سدود طويلة من صخور بازلتية وديورتية الخ تقطع جميع ما يسبقها من الصخور وكل الصخور اللاحقة للجرانيت الأول من أصلى نارى مصهور .

ملخص المحاضرات

التى ألقيت بجلسة يوم الاثنين الموافق ٦ ديسمبر ١٩٥٤

١ — ل . ر.كوكس — قراءة م .ا.عطية — المحارات المزدوجة فى تكوينات الحجر الرملى النوبى فى مصر .

إن بعض المحارات المزدوجة التى جمعت من تكوينات الحجر الرملى النوبى من المنطقة شرقى أسوان أرسلت إلى الدكتور ل . ر . كوكس وقد عرف منها ثلاث حفريات بحرية منها نوعان جديدان كما عرف ثلاث حفريات نهرية ثلاث منها (وربما أربعة) من أنواع جديدة . وقد أشار إلى أن (Iridina) وجنسيتها (Afriant) الذى هو حالياً من النوع (Pleiodon) كانت موجودة فى مصر فى العصر الطباشيرى .

٢ — ف . فيكينتييف — السلفيوم والطقوس الدينية فى تجديد القوة

فى كل الشرق الأوسط ومنذ العصر السميرى والأصول المصرية الليبية للحضارة النيلية كان هناك نوع رائج الاستعمال من صمغ نبات على شكل مظلة مستعملا معروفاً بأسماء مختلفة « كرائحة ليبية » أو الاسيريتيوم أوسليفيوم ووصلنا أسمه الأكادى وهو « خلتيت » محلولا إلى « حلتيت » وظل استعمال هذا أيضاً من العصور القديمة إلى الآن كقوى ومنعش . وعرفه القدماء من عصر منيس واستعمل كدواء فى نفس الحالات التى يستعمل فيها الآن وكان استعماله الأول أثناء احتفالات باعادة التتويج وتدعى حب سد لإعادة قوته الأولى إلى الفرعون الكهل . ويعطى له أثناء ماكان يعدو عدواً مقدساً واستعمل أيضاً كبهرات للطعام عند انتهاء الحفلة .

الجلسة العلنية فى ١٠ يناير ١٩٥٥

عقد الاجتماع فى الساعة ٦ مساء بدار المجمع بحضور السادة المحترمين .

مجلس الإدارة :

الدكتور محمد كامل حسين	الرئيس
المسيو ش . كونس	السكرتير العام
الأستاذ ل . كيمر	السكرتير المساعد
واعتذر الدكتور ا . ج . ليفى	أمين الصندوق والمكتبة

أعضاء عاملون : الأب قنواتى . الفيرى . أفرينو . بالوج . بشر فارس . خريستوف . كامل غالب . جوبى . إلهامى جريس . جيرو . حامد زكى . هيكمان . يونجفليش . لاوير . م . مدور . مراد كامل . اسماعيل راتب . عثمان رفقى رستم .

واعتذر السادة : ر . قطاوى . محمد مصطفى . سامى جبره . طه حسين . والعضو المنتسب جرومان .

أعضاء مراسلون: عبد المحسن الخشاب . اسكندر بدوى . ابراهيم المويلحى حسن عبد الوهاب . ج . ميخاليدس .

المدعوون : مدام بيانش . مدام مملوك . مدام عيروط . مدام تاجر . الأب عيروط . أحمد رشاد . على شافعى . بروجمان . ديبين . جامبر . جارنو . هونجزبرج . السير وليام سمارت . فينيزيللو وعقيلته . وايلد .

١ — قرأ السكرتير العام محضر جلسة ٦ ديسمبر سنة ١٩٥٤ واعتمد .

٢ — هنأ الرئيس (ا) الدكتور طه حسين لاختياره مديراً لإدارة الثقافة العامة بجامعة الدول العربية .

(ب) الأستاذ كيمر لمنحه نيشان من طبقة فارس .

(ج) الدكتور هيكمان على :

ملخص المحاضرات

التى ألقيت بجلسة الاثنين ١٥ نوفمبر ١٩٥٤

١ — المسيو يونجفليش — « فتوح الجنوب » من نقوش العملة التركية المصرية :

يؤخذ من نقوش على بعض العملة الصغيرة التى ضربت فى مصر سنة ٩٢٦ ﻫ أنها ضربت لتسجيل « فتح الجنوب » أيام سليم الأول وربما أيضاً لإنهاض الهمم لغزو الشمال ذلك الغزو الذى تم فى عهد سليمان الأول .

٢ — الدكتور هيكمان — الرقص أمام المرايا

يتمثل الرقص أمام المرايا على مصطبة ميريروكا بسقارة وهو يمثل نوعاً من الرقص تقوم به بعض الفتيات الصغيرات اللاتى يوقعنه على نغمات بعض الآلات وتنعكس صورهن على المرايا وكان من السهل الوقوف على معانى هذا النوع من الرقص الذى كان متبعاً فى عهد الامبراطورية القديمة وهو يمثل أنواعاً مختلفة تمكننا من دراسة الأوضاع الموسيقية لهذا الرقص القديم . وهناك نوع ثان ممثل على المصطبة المشار إليها درس دراسة موسيقية مفصلة ، وإعادة تمثيل هذه الأوضاع لرقص السيقان تلقى ضوءاً جديداً على الحركات والأنغام التى كانت مستعملة لدى المصريين القدماء فى عهد الامبراطورية القديمة .

٣ — الدكتور شوقى مصطفى — الحيوانات المستأنسة المكتشفة حديثاً فى هرم سقارة الجديد :

فى حفرة غير عميقة فوق هرم سقارة الجديد وجدت مجموعة من عظام الحيوانات المستأنسة التى عند الفحص وجدت تتكون من بقايا الخروف والماعز والكلب والحمار والخنزير والثيران ، والجديد فى هذا الاكتشاف أنه يثبت أن قدماء المصريين أيام الأسرة السادسة والعشرين كانوا يربون الخنازير والحمير وليس من المستبعد أن تكون هذه الحيوانات من القرابين أو كانت تستعمل فى أغراض الطب والسحر .

الجلسة العلنية فى ٦ ديسمبر سنة ١٩٥٤

عقد الاجتماع بدار المجمع العلمى المصرى بالقاهرة فى الساعة ٦ مساء بحضور السادة المحترمون .

مجلس الإدارة :

الدكتو محمد كامل حسين	الرئيس
المسيو كونس	السكرتير العام
الدكتور ليفى	أمين الصندوق والمكتبة
الأستاذ كيمر	السكرتير المساعد

أعضاء عاملون : الأب قنوانى . الغبرى . محمود ابراهيم عطية . قطاوى . خريستوف . كامل عثمان غالب . جوبى . جريس . لاوير . منصور فهمى . اسماعيل راتب . عثمان رفقى رستم . طه حسين .

واعتذر السادة : هيكمان . يونجفليش . سامى جبرة .

أعضاء مراسلون : عبد المحسن الخشاب . اسكندر بدوى . ميخاليدس . ابراهيم المويلحى .

واعتذر السيد حسن عبد الوهاب .

المدعوون : مدام إلا اميان . مدام تيكهولم . مدموازيل ضياء أبو غازى . السادة حسان عوض . كروتكوف . موللر . ياهور لبيب . موريس روفائيل . سليمان عزمى فينزيللو وعقيلته . فيكنتيف وعقيلته .

١ — قرأ السكرتير العام محضر جلسة ١٥ نوفمبر ١٩٥٤ ثم ووفق عليه .

٢ — أعلن الرئيس نبأ وفاة المسيو فيلارد العضو المنتسب من ٩ فبراير ١٩٤٩ والمسيو سترومر العضو المراسل من ٢١ فبراير ١٩٣٨ .

٣ — ألقى الأستاذ محمود إبراهيم عطية محاضرة المستر كوكس عن « المحارات المزدوجة فى تكوينات الحجر الرملى النوبى فى مصر .

٤ — ألقى المسيو فيكنتييف محاضرته عن « السلفيوم والطقوس الدينية فى تجديد القوة » .

وانتهى الاجتماع فى الساعة ٧ر٥ مساء ثم عقد المجمع لجنة خاصة .

السكرتير العام

كشف الأعضاء المراسلين بالمجمع العلمى المصرى

لغاية ٣٠ يونيه سنة ١٩٥٥

ف . فودرا — ٩ نوفمبر ١٩٠٠
ديمترى كالمياكوس — ٩ يناير ١٩١٢
مايوس داللوفى — ١٠ فبراير ١٩٣٦ (الجزائر)
اورديتو ديسبو « « « (ميلان)
روبرت دولفوس « « « (باريس)
جوزيف ليبوفتش « « «
لويس دونسي — أول فبراير ١٩٣٧
مارسيل مونيرو — دومان — ٤ مارس ١٩٤٠ (بورسعيد)
ريموند يابيس — ٦ مارس ١٩٤٧ (باريس)
جان دوريس — — ١٩ فبراير ١٩٤٩
كيث سيل « « « (شيكاغو)
كوستانتينو بريشيانى تورونى — ٤ فبراير ١٩٥٠ (ميلان)
الفرد فونتين « « « (الاسماعيلية)
عبد الفتاح حلمى — ٣ فبراير ١٩٥١ (القاهرة)
عبد المحسن الخشاب « « « «
عبد النبي النحاس « « « «
ابراهيم المويلحى « « « «
جورج ميخاليدس « « « «
محمد مهدى « « «
جاك شوارتز « « « (ستراسبورج)
روبرت فريد نجربرانتر — ١٩ فبراير ١٩٥٢ (فينا)
عبد الرحمن زكى « « « (القاهرة)
اسكندر بدوى « « « «
جاندلون (رينيه) — ٨ فبراير ١٩٥٤ (شالون سيرمورن)
حسن عبد الوهاب « « « (القاهرة)
كومورزنيسكى (ايجون) « « « (فينا)

الجلسة العلنية فى ١٥ نوفمبر ١٩٥٤

عقد الاجتماع فى الساعة ٦ مساء وكان الحاضرون السادة المحترمين :

الدكتور محمد كامل حسين .... الرئيس
المسيو كونس .... السكرتير العام
الدكتور ليفي .... أمين الصندوق والمكتبة
الأستاذ كيمر .... السكرتير المساعد

أعضاء عاملون : الأب قنواتى ، أفرينو ، بالوج ، خريستوف ، غالب ، جوبى ، جريس ، هيكمان ، اسماعيل راتب ، يونجفليش ، لاوير ، محمد كامل مرسى ، محمد مصطفى ، عثمان رفقى رستم ، سامى جبره .

أعضاء مراسلون : عبد المحسن الخشاب ، اسكندر بدوى .

المدعوون : مدام هيكمان ، مدام يونجفليش ، مدموازيل ضياء أبوغازى ، باثمر ، ديبونو ، كرتكوف ، لوفى ، مرزينى وعقيلته ، شوقى مصطفى ، فينزيلو وعقيلته ، فيكنتييف ، جوبوت .

١ — قدم الرئيس التحية للدكتور محمد مصطفى العضو الجديد .

٢ — هنأ الرئيس المسيو لاوير لنيله نيشان شفالييه ، والدكتور بشر فارس لنيله جائزة مارمور ١٩٥٤ وواصف بطرس .

٣ — أعلن السكرتير العام نبأ وفاة الدكتور ميهالوف العضو المراسل من ٦ فبراير ١٩٣٩ — ١٩٤٧/٤/٢٢ والعضو العامل ابتداءاً من ٢٣ ابريل ١٩٤٧ .

٤ — عرض السكرتير العام الأبحاث المهداة إلى المجمع من السادة روبرى دونتاس . فيلد . ويجنجادون فشكرهم الرئيس ، ولفت المسيو جوبى النظر إلى بحث المسيو رينيه تاتون .

١ — قرأ المسيو يونجفليش محاضرته عن فتوح الجنوب .

٢ — قرأ المسيو هيكمان محاضرته عن الرقص أمام المرايا .

٣ — قرأ الدكتورشوقى مصطفى محاضرته عن (الحيوانات المستأنسة المكتشفة حديثاً فى هرم سقارة الجديد وأبدى الأستاذ كيمر بعض الملاحظات .

٤ — وانتهى الاجتماع فى الساعة ١٥ر٧ ثم عقد المجمع لجنة خاصة .

كشف الأعضاء المنتسبين بالمجمع العلمى المصرى

لغاية ٣٠ يونيه سنة ١٩٥٥

لويس مرازك — ١٩ يناير ١٩١٤

بيير دى فريجيل — ٤ يناير ١٩١٨

اميل بروميت — ٧ يناير ١٩٢٤ (باريس)

جولز بارتو — ١٢ يناير ١٩٢٥ (باريس)

فرانسوا شارل رو — ١٢ يناير ١٩٢٥ (باريس)

جاستون جونديه — ١١ يناير ١٩٢٦ (درى)

جاستون فليرى — ١٧ يناير ١٩٢٧ (بيكون — اسنير — سين)

اندريه لالاند — ٩ يناير ١٩٢٨ (اسنيير ، سين)

جورج أرفانيتاكى — ١٣ مايو ١٩٢٩ (أثينا)

جيرهارد ـ اسوالدلوتسى — ٤ مايو ١٩٣١ (كازابلانكا)

اثاناس ج . بوليتيس — ٩ مايو ١٩٣٢

إتيين روبيه — أول مايو ١٩٣٣ (ماندلى ، الب ماريتيم)

إفارستو بريشيا — ٧ مايو ١٩٣٤ (روما)

بيير لاكو — ١٠ مايو ١٩٣٧ (باريس)

اليساندروجيجى — ٢١ فبراير ١٩٣٨ (بولونيا)

جاك هادامار — ٢١ فبراير ١٩٣٨ (باريس)

ادولف جروهمان — ٢١ فبراير ١٩٣٨ (القاهرة)

شارل اندريا — ٢١ فبراير ١٩٣٨ (زيورخ)

جان كوفييه — ٥ ديسمبر ١٩٣٨ (باريس)

هارولد ادريس بل — ٤ مارس ١٩٤٠ (أبريستويث)

سبيرو دونتاس — ٤ مارس ١٩٤٠ (أثينا)

ماريوس جيرولانوس — ٤ مارس ١٩٤٠ (أثينا)

اميل مينوست — ١٣ مايو ١٩٤٦ (باريس)

فان وينخردن — ٥ فبراير ١٩٤٧ (ليد)

هاملتون اليكساندر روسكين جيب — ٥ فبراير ١٩٤٧ (اكسفورد)

جوستاف ليفيير — ٥ فبراير ١٩٤٧ (فرساى)

إدواردو فولتيرا — ٥ فبراير ١٩٤٧ (بولونيا)

لويس ماسينون — ٥ فبراير ١٩٤٧ (باريس)

ألن هـ. جاردنر — ٥ فبراير ١٩٤٧ (اكسفورد)

جاروسلاف تشرنى — ٩ فبراير ١٩٤٨ (اكسفورد)

الفردباريول — ٩ فبراير ١٩٤٨ (باريس)

لورنس بولز — ٥ أبريل ١٩٤٨ (كمبردج)

هربرت جون فلير — ٤ فبراير ١٩٥٠ (لندن)

اتواى هنرى لتل — ٢٠ مايو ١٩٥٠ (لندن)

موريس دى ڤى — ٢٠ مايو ١٩٥٠ (كيب تون)

وارن رويات داوسن — ٣ فبراير ١٩٥١ (بكس)

حسن حسنى عبد الوهاب — ٣ فبراير ١٩٥١ (تونس)

جوزيف يالس— ٣ فبراير ١٩٥١ (ليد)

بيير مونتيه — فبراير ١٩٥١ (باريس)

إميليو جارثيا جومت — ١٩ فبراير ١٩٥٢ (مدريد)

جورج ويليام ويلسون مرى — ١٩ فبراير ١٩٥٢ (ابردنشاير)

دريوتون (اتيين) — ٢ نوفمبر ١٩٥٣ (مونتجيرون)

فييت (جاستون) — ٢ نوفمبر ١٩٥٣ (باريس)

ما يلزم (جورج كاربنتر) — فبراير ١٩٥٤ (نيويورك)

مونتل (بول) — ٨ فبراير ١٩٥٤ (باريس)

بورتيفان (ألبرت مارسيل جرمان رينيه)—٨ فبراير١٩٥٤(سانت جرمان الدير)

فان دى فان (بودوين) — ٨ فبراير ١٩٥٤ (بركسل)

بوايبه (أندريه جان) ٦ ديسمبر ١٩٥٤ (بوردو)

ساندر هانسن (كونستانتين أميل) ٧ فبراير ١٩٥٥ (كوبنهاجن)

لويس كيمر — أول فبراير ١٩٣٧ (ج . ب . بيوبك)
شارل كونس — ٢١ فبراير ١٩٣٨ (ب . لاكو)
سامى جبره — ٢٠ ينابر ١٩٤١ (ش . دى سيربون)
أكتاف جيرو — ٩ مارس ١٩٤٢ (ف . بيتر)
مارسيل يونجفليش — مارس ١٩٤٤ (ج . فوكار)
محمد شفيق غربال — ١٦ ينابر ١٩٤٧ (الأب ب . سباث)
سليمان أحمد حزين — ٢٣ أبريل ١٩٤٧ (أحمد عيسى بك)
بشر فارس — ٥ أبريل ١٩٤٨ (الشيخ مصطفى عبد الرازق)
مصطفى عامر — ١٧ مايو ١٩٤٨ (الأب ب . بوفييه لابيير)
عثمان رفقى رستم — ١٤ مايو ١٩٤٩ (د . باكوندا كى)
مراد كامل — ٢٢ أبريل ١٩٥٠ (توجومينا)
الأب قنواتى — ٣ فبراير ١٩٥١ (عبد المجيد عمر باشا)
جان فيليب لاوير — ٣ فبراير ١٩٥١ (دى ڤى)
جان ادوارد جوبى — ٢٢ مايو ١٩٥٢ (ج . ا . كريج)
خريستوف (لويس . ا) — أول مارس ١٩٤٩ (اتيين دريوتون)
هيكمان (هانز) — أول مارس ١٩٥٤ (ج . فييت)
محمد مصطفى — ٣ مايو ١٩٥٤ (محمد محمود خليل)
جارنو (جان سان فار) ٢ مايو ١٩٥٥ (ج . ف . أنرب)

القسم الثانى : العلوم الاقتصادية والسياسية .

ا . ج . ليفى — ٤ ديسمبر ١٩١٦ (ج . باروا)
منصور فهمى — ٣ أبريل ١٩٢٢ (ج . فاست)
فينسانزو أرانجو رويتز — ٦ فبراير ١٩٣٣ (ا . بوليتيس)
رينيه قطاوى — ٧ فبراير ١٩٤١ (و . ف . هيوم)
عبد الحميد بدوى — ٥ أبريل ١٩٤٨ (فريد بولاد بك)
محمد كامل مرسى — ٢٦ مايو ١٩٥١ (محمد خليل عبد الخالق بك)
حامد زكى — ١٢ يناير ١٩٥٢ (ا . ه . لتل)
حلمى بهجت بدوى — ٣ مايو ١٩٥٤ (ا . لوزينا)

القسم الثالث : العلوم الطبيعية والرياضية :

هارولد ادوين هرست — ٥ ديسمبر ١٩٢١ (محمد مجدى باشا)
كامل عثمان غالب — أول فبراير ١٩٣٧ (محمد شاهين باشا)
حسين سرى — ٢١ فبراير ١٩٣٨ (اسماعيل سرى باشا)
محمد رضا مدور — ٤ مارس ١٩٤٠ (ج . كوفييه)
اسماعيل راتب — ٦ ديسمبر ١٩٤٨ (ا . موكى)
مصطفى نظيف — ٢٢ مايو ١٩٥٢ (ب . دى كومنين)
تركى (أحمد رياض) ٤ أبريل ١٩٥٥ س . ميهالوف)

القسم الرابع : الطب والهندسة والتاريخ الطبيعى :

وليام هوكنز ويلسون — ٧ ديسمبر ١٩٠٨ (ليون فيدال)
جورجى صبحى — فبراير ١٩٣٦ (أحمد زكى باشا)
كريستو أفرينو — ٦ مارس ١٩٤٤ (ث . بابا يونو)
محمد كامل حسين — ٢ أبريل ١٩٤٥ (ت . كراوس)
محمد صبحى — ١١ مارس ١٩٤٦ (ماير هوف)
محمود ابراهيم عطية — ٤ فبراير ١٩٤٦ (ج . فيرانت)
انستاس الفيرى — ٦ مارس ١٩٤٧ (و . ريتشى)
حسين فوزى — ٨ مارس ١٩٤٨ (على باشا ابراهيم)
هنرى ف . موصيرى — ٨ مارس ١٩٤٨ (ا . لوكاس)
روجير جودل — ٥ أبريل ١٩٤٨ (ل . بولز)
بول بالوج — ١٩ نوفمبر ١٩٤٩ (ا . سامركو)
حسن شاكر أفلاطون — ٣ فبراير ١٩٥١ (على مصطفى مشرفة باشا)
بول غاليونجى — ٢٢ مايو ١٩٥١ (ج . و . مرى)
جريس (إلهامى) — أول مارس ١٩٥٤ (سعد الله مدور)
الحلوانى (أحمد) — ٤ أبريل ١٩٥٥ (ج . بواييه)

حساب مكافآت ترك الخدمة

مليم	جنيه	البيان	مليم	جنيه	البيان
٠٠٠	٤٠٠	أودع بالبنك فى ١٩٥٤/٧/١			
٠٠٠	٣٠٠	أودع بالبنك فى ١٩٥٥/٢/١١			
٠٠٠	٥٠٠	أودع بالبنك فى ١٩٥٥/٥/١٩			
٠٠٠	١٢٠٠				
			٧٤٥	٢١	مكافأة ورثة المرحوم عبد السميع محمد عبد الوهاب المغربى . (صرفت لوالده محمد عبدالوهاب المغربى بشيك رقم ٦٠٠٧٢٦ فى ٥٥/٧/١٧)
٢٥٥	١١٧٨	الباقى بالبنك لغاية ١٩٥٥/٦/٣٠			
٩٤٥	١١٧٧	الرصيد الباقى	٣١٠	—	مصاريف بنك (١٠ + ٢٥٠ + ٥٠)

أمين الصندوق

مراقب الحسابات

الدكتور فؤاد احمد الصواف

القاهرة فى ٥ ديسمبر ١٩٥٥

مجلس الادارة خلال سنة ١٩٥٥

الأستاذ الدكتور سليمان أحمد حزين	الرئيس
الأستاذ ل . كيمر	نائبا الرئيس
الأستاذ سامى جبره	نائبا الرئيس
المسيو ش . كونس	السكرتير العام
الدكتور ا . ج . ليڤى	أمين الصندوق والمكتبة
الأستاذ ج . ف . لاوير	السكرتير المساعد

لجنة المطبوعات

(بجانب أعضاء المكتب الذين لهم الحق فى حضور هذه اللجنة)

ر . قطاوى

ا . جيرو

ج . يونجفليش

مصطفى عامر

كشف الأعضاء العاملين بالمجمع العلمى المصرى

لغاية ٣٠ يونيه سنة ١٩٥٥

التاريخ المذكور أمام كل عضو هو تاريخ انتخابه. أما الأسماء التى بين الأقواس فهى أسماء الأعضاء السابقين الذين حل محلهم الأعضاء الحاليون .

القسم الأول : الآداب ، الفنون الجميلة ، الآثار .

أحمد لطفى السيد — ٦ ديسمبر ١٩١٥ (السيد كيرلص ماكير)

طه حسين — ٧ أبريل ١٩٢٤ (أحمد كمال باشا)

ومن جهة أخرى فقد دعى المجمع لحضور المؤتمر الآتى ولم يكن فى الإمكان إيفاد من يمثله .

١ — الاجتماع الدولى الخاص بمشكلات البحث العلمى المنعقد فى ميلان من ١٢ — ١٩٥٥/٤/١٤

بيـان : أسف المجمع فى هذه الدورة لفقد :

أعضاء عاملين : ج . ف . انرب و س . ميهالوف .

أعضاء منتسبين : أوجو مونريه دى فيلارد .

الانتخـــابات : تم انتخاب :

أعضاء عاملين : الدكتور جان سان فارجارنو . الدكتور أحمد الحلوانى . الدكتور أحمد رياض تركى .

أعضاء منتسبون : المسيو كونستانتين أميل ساندر هانسن .

ويتكون المجمع الآن من ٥٠ عضواً عاملا . و٥٠ عضواً منتسباً . و٢٦ عضواً مراسلا .

(أنظر فيما بعد الكشف المبين لترتيب الأعضاء) .

الحساب عن سنة ١٩٥٤ — ١٩٥٥

(من ١٩٥٤/٧/١ إلى ١٩٥٥/٦/٣٠)

الإيرادات :

مليم	جنيه	
٩٤٤	٢٢١٦	رصيد لغاية ٥٤/٦/٣٠ وبيانه :
٢٠٠	٣٣٩٣	إعانة وزارة التربية والتعليم
٤٠٨	١٩٣	مبيعات
٠٠٠	٥٨٠	تبرعات ونشر إعلانات بالمجلة
٨٩٠	٨	فوائد على الحساب الجارى بالبنك
٤٤٢	٦٣٩٢	جملة الإيرادات

مليم	جنيه	
٥٤٤	٢٢٠٦	رصيد بالبنك فى ٥٤/٧/١
٠٠٠	١٠	سلفة للمصروفات النثرية
٤٠٠		تأمين مياه

المصروفات :

مليم	جنيه	
٧٥٠	١٠٧١	مرتبات ومكافآت
٧٧١	١٨٨٢	طبع مجلات ونشرات
٥٣٥	٨	كتب مشتراة
٤٤٧	١١٩	بريد
٨٧٤	٢٦	مياه ونور وتليفون
٢١٥	٧٢	أدوات كتابية ومطبوعات
٠٠٠	٢٠	أتعاب مراجعة
٨٠٧	٤٣	أدوات نظافة ومتنوعة
٨٣٠	٤٩	تجليد
٣٥٠	١٤	صيانة وتصليح
٦٦٢	١	ضريبة على فدائد الحساب الجارى بالبنك
٥٢٧	٥	مصاريف بنك وفروق كامبيو
٠٠٠	١٢٠٠	المخصص لمكافآت ترك الخدمة للموظفين والعمال
٢٠٠	٦٤	أثاث
٩٦٨	٤٥٨٠	
٤٧٤	١٨١١	وبيانه كالآتى :
٤٤٢	٦٣٩٢	

مليم	جنيه	
٠٧٤	١٨٠١	رصيد البنك فى ٥٤/٦/٣٠
٠٠٠	١٠	سلفة للمصروفات النثرية
٤٠٠	—	تأمين مياه

أمين الصندوق　　　　مراقب الحسابات

الدكتور فؤاد احمد الصواف

القاهرة فى ٥ ديسمبر ١٩٥٥

تقرير

عن أعمال المجمع العلمى المصرى خلال سنة ١٩٥٤ — ١٩٥٥

الجلسات : عقد « المجمع » فى هذه الدورة سبع جلسات عادية وجلستين تكميليتين .

المطبوعات : قام « المجمع » خلال هذه السنة بطبع المجلد السادس والثلاثين جزء أول وثانى من مجلته .

تبادل المطبوعات : تبادل « المجمع » مطبوعاته مع ٣٥٠ جمعية علمية فى مصر والخارج .

المكتبة : تلقت المكتبة خلال هذة المدة ١٢٩ مجلداً بطريق الإهداء والتبادل وقد بلغت محتوياتها الآن ٤٠٣٦٤ كتاباً (عدا المطبوعات الدورية الواردة من الجمعيات العلمية) .

المؤتمرات والحفلات الرسمية : مثل « المجمع » فى المؤتمرات الدولية الآتية :

١ — المؤتمر الدولى الخامس المتعلق بأسماء الأعلام المنعقد فى سلامنك خلال أبريل ١٩٥٥ .

٢ — المؤتمر الدولى السادس للموسيقى المنعقد فى أكسفورد من ٢٩ يونية — ٤ يولية ١٩٥٥ .

٣ — مؤتمر الألمان المستشرقين المنعقد فى همبورج من ٢٧—٣١ يولية ١٩٥٥.

٤ — المؤتمر الدولى السابع للبابيرولوجى المنعقد فى فينا من ٨/٢٩ — ١٩٥٥/٩/٣ .

٥ — المؤتمر العربى العلمى الثانى المنعقد فى الاسكندرية من ٥ — ٩/١٢ — سنة ١٩٥٥ .

٦ — المؤتمر الدولى العاشر للدراسات البنزنطية المنعقد فى اسطنبول من ١٥— ١٩٥٥/٩/٢١ .

[مستخرج من مجلة المجمع العلمى المصرى – العدد ٣٧ (١٩٥٤ – ١٩٥٥)]

تقـــــرير


عن أعمال المجمع العلمى المصرى

خـلال ١٩٥٤ – ١٩٥٥

وكشف بأسماء الأعضاء

١٩٥٨

مطابع دار النشر للجامعات المصرية
علاء الدين الشيتى وشركاه (شركة توصية بالأسهم)
٤٢ شارع شريف – بالقاهرة


GEOLOGICAL EXPOSURE MAP
OF THE
ASWAN AREA
EGYPT
by A. R. Gindy
BASED ON THE 1:10.000 TOPOGRAPHICAL SHEETS OF THE ORDNANCE SURVEY OF EGYPT
Triangulation Point
Built-up inhabited areas
Northern half of Map
Southern half of Map
N
RIVER NILE
ASWAN
Sehel Island
Saluja Island
Awad Island
Biga Island
El Hesa Island
Aswan Dam
Aswan-Dam motor road
British cemetery
SHADIAB
KUTI
GEBEL TOGOK
G. BAS
G. ZILIGA
MAHATTA
SEHEL
GARBA
MESITOT
RASHKA
ARADUL
ARAKINI
SELEKIA
SABNARI
KOROR
DAM COLONY
BALLI
FAGIRTOGOK
KHOR
HAFIR RUINS
BUGGA RUINS
MISHEK RUINS
ABD EL ASUI RUINS
TICHI RUINS
TENGAR
AJARMA RUINS
MAHODDA RUINS
EL SHELLAL STATION
GEBEL SHISHI
Coastguards station
new road to El Shellal being constructed during survey
railway to Aswan town and to El Shellal
unfinished sarcophagus
EXPLANATION
Semipelitic & Pelitic Biotite Schists & Fine-grained Biotite Gneisses.
Metadolerites (Hornblende Schists & Gneisses, Amphibolites etc.) including meragabbros, old diorites and so called anorthosites.
Medium grained Biotite & Hornblende Gneisses with Felspar Porphyroblasts in parts merging into fine medium and coarse grained granodiorites and old migmatitic granites.
Granodiorite-looking Dark Rocks with Large Felspar Porphyroblasts (Mostly After Metadolerites)
Coarse Aswan Granite including autochthonous, subautochthonous and rheomorphic varieties; culminating from migmatites; Mostly post-deformation.
'Intermediate Granite' Discrete post-granitisation segregations within the migmatites.
Fine-grained New Granite True intrusive magmatic granite with occasional mechanical inclusions of all preceding rocks, probably evolved at depth from the same migmatites/country rock of the geosyncline. Small intrusions shown as aplites.
small blank patches
Pegmatites & Aplites of diverse age and origin: pre-, para- & post-deformational; dilation, non dilation replacement and intrusive.
Late Minor Dyke & Neck Intrusions, when sliced
DR: DIORITE CM: CAMPTONITE
B: BOSTONITE D: DOLERITE
AB: AMYGDAL. DOL. Z: XENOLITHIC
Nubian Sandstone
left blank
Alluvial Deposits
Blown Sand
STRUCTURAL SIGNS
FAULT LINES
SMALL SHEAR BELTS
For Pelites & Semipelites
STRIKE AND DIP OF FOLIATION
HORIZONTAL AND VERTICAL FOLIATION
TREND OF LINEATION ON FLAT SURFACES
TREND AND PLUNGE OF SMALL FOLD AXES
For Metadolerites
STRIKE AND DIP OF PLANES OF FOLIATION
TREND AND PLUNGE OF LINEAR STRUCTURES
TREND OF LINEATION ON FLAT SURFACES
For Granitic Rocks
STRIKE AND DIP OF PLANES OF FLOW OR FOLIATION
MOSTLY WEAK FLOW LINES ON FLAT SURFACES
N.B. TO AVOID OVERCROWDING OF DETAILS THE AMOUNT OF DIP IS OMITTED IN SOME SIGNS BUT STEEP DIPS ARE INDICATED THUS. ALSO IN SOME CASES THE SIGNS ARE SHIFTED TO THE NEAREST SPACE. ROCKS OF THE DISTRICT AROUND EL HESA ISLAND ARE STRONGLY STRAINED.
SCALE 1:10.000
Kilometres
METRES
GEOLOGICALLY SURVEYED DURING APRIL, MAY & OCTOBER 1951
A. R. Gindy 1951
PHOTOGRAPHICALLY REDUCED FROM ORIGINAL SCALE



مجلة
المجمع العلمى المصرى

المجلد السابع والثلاثون

الجزء الثانى

(١٩٥٤ — ١٩٥٥)

القاهرة

طبع بمطابع
دار النشر للجامعات المصرية
علاء الدين الشيتى وشركاه (شركة توصية بالأسهم)
٤١ شارع شريف - بالقاهرة

١٩٥٦